# "PRODUCTION AND PRODUCTIVITY PERFORMANCE OF PULSES AND THEIR CONTRIBUTION IN INCOME AND EMPLOYMENT ON FARMS IN CHITRAKOOT DHAM REGION OF U.P. STATE"

**THESIS**

**SUBMITTED TO**

**BUNDELKHAND UNIVERSITY, JHANSI**

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**IN**

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## Certificate

*This is certified that thesis entitled* ***"Production and productivity performance of pulses and their contribution in income and employment on farms in Chitrakoot Dham region of U.P. state"*** *submitted for the Award of Ph.D. degree in Agricultural Economics, Faculty of Agriculture by Roop Ram Kushwaha embodies the results of the bonified research work carried out by him under my guidance and supervision. No part of the study reported here has so for been submitted any where for any other degree or diploma.*

*The Roop Ram Kushwaha has worked under me more than the period required under the Ph.D. degree ordinance 7 of the university and has put in required attendance in the department during that period.*

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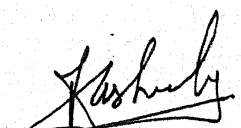

**Place :- Rath (Hamirpur)** **(Ram Roop Kushwaha)**

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Chapter - I

# INTRODUCTION

# INTRODUCTION

India has the largest distinction of being the largest producers of pulses in the world. India is an agricultural country where agriculture is considered as a prime industry. About 64 percent of the total population of the country is engaged in agriculture that contributes about 29 percent of the total national income. As against this, the proportion of agricultural income to the total national income in U.K. is only 3.1 percent, in U.S.A. 3.2 percent, in Canada 7.0 percent, in France 6.0 percent and Japan 8.7 percent. In the developed countries of the world, agriculture contributes less to the national income as compared to the developing countries.

Of the total agricultural crops grown in India, pulses are most important because they are the major source of protein to the majority of the people in the country who live on vegetarian diet. Pulses not only have nutritional value for human beings but also contribute to soil fertility besides providing nutritious green fodder and feed to live-stock. Pulses provide the most important food ingredient of protein in diet and are 2-3 times richer in protein than most of cereals.

Pulses are grown over an area of 22.8 million hectares with a production ranging from 12.94 million tonnes (accounting for 17 percent of the total area and 7 percent of the total food grain

production). The yield per hectare ranges between 500-600 kg per hectare. Pulses are grown mainly under rain fed conditions. The irrigated area accounts for only 8 percent of the total area. The major pulses producing states in the country are Uttar Pradesh, Madhya Pradesh, Maharashtra, Orissa and Rajasthan which accounted for about 67 percent of the total production of the country.

The production of pulses which had declined in the drought years 2000-01 and 2001-02, increased substantially to a record of 12.96 millions tonnes during 2002-03 exceeding the peak level of 13.4 million tonnes during 1999-2000. The increase of 2.5 million tonnes of pulses in 2002-03 or 2001-02 was contributed by 1.1 million tonnes of kharif pulses (mainly Arhar) which increased from 4.2 million tonnes to 5.4 million tonnes and by about 1.3 millions tonnes of Rabi pulses (mainly Gram) which increased from 6.4 million tonnes to 7.9 million tonnes. The increase in productivity came in the wake of Special Food Grains Production Programme implemented in 28 selected districts of gram producing states. Despite many efforts made to increase the production of pulses, it has not brought about any perceptible change in per capita availability. In fact pulse production has shown a declining trend during the last two decades. As a result per capita availability has declined over the last years from 69 grams per day in 1991 to around 40 grams per day in 2001. With increased emphasis on balanced nutrition, the declining per capita availability has indeed been a cause of concern. The increase in production has not kept pace with the increase in population. To increase the availability of pulses, the import of pulses

has been allowed under open general licence and it has grown from 2.21 lakh tonnes during 2001-01 to 8.16 lakh tonnes during 2002-03.

In order to encourage higher production and to arrest the declining trend in the per capita availability, its production in 2002-03 had been targeted at 14.6 million tonnes (5.5 million tonnes during Kharif and 9.1 million tonnes during Rabi season). This had been sought to be achieved through several pulses development programmes like National Production Programme. The main objective of National Pulse Development Project was to increase the production by adopting location specific technology. It comprised of distribution of improved seeds, block demonstrations, adaptive trails of promising varieties, pest control, extension work and plant protection. National Pulses Development Project was supplemented by a special programme under Special Food grains Production Programme launched in 13 states covering schemes of plant protection, expansion of area under summer moong/urd through distribution of seeds at concessional rates. Besides, pulses have also been brought within the purview of Technology Mission. The target fixed for pulses production at the end of the 10$^{th}$ Plan, the Government of India decided it to be at 20 million tonnes.

The area under pulses in Utter Pradesh during the year 1990-91 was 3724.829 thousand hectares with a production of 3069258 metric tonnes which declined to 2986.047 thousand hectares of area and 2412726 metric tonnes of production during the year 2001-02. Likewise

the productivity showed a declining trend. The productivity declined from 8.24q/ha to 8.08q/ha during the period 1990-91 to 2002-03.

In Uttar Pradesh, Chitrakoot Dham region is famous for pulse production. In Chitrakoot Dham the pulse production takes place under rainfed conditions because of lack of irrigation facilities on one hand and typical physiography on the other. Chitrakoot Dham accounts for 18.11 percent of the total area and 25.67 percent of the total production of the state. The productivity of pulses in Chitrakoot Dham was higher in the state being 8.76 q. per hectare as against 8.08 q. of the state during the year 2001-02.

The area under pulses in district Chitrakoot Dham during the year 2002-03 was 218.9 thousand hectares with a production of 1946.27 metric tonnes. The average yield per hectare was recorded quite low i.e. 9.1 quintals. The Government of India stressed upon boosting the production of pulses on the lines similar to those taken six years ago to raise oilseeds production when the import bill of this commodity exceeded Rs. 1500 crores, next only to the import of petroleum. The mission has viewed seriously in the context of various efforts being made to increase productivity through yield increasing technology.

The pulse production in the state as well as in the area did not show any appreciable increased for last forty years rather it has declined. The growth of pulse production in the state was (-) 0.11 percent per annum and that of in Chitrakoot Dham (+) 0.62 percent per annum and in Banda district (+) 2.71 percent per annum. This slow

growth is no growth in pulses was due to many constraints in its production. So far no such high yielding strains of pulses have been evolved which would have brought break through in its production. Besides the pulse production suffer from high infestation of diseases and pests. These circumstances call for an intensive enquiry into the constraints in pulse production.

Keeping in view the importance of pulse production in Chitrakoot Dham of UP; this study has conducted to make an assessment of pulse growers and suggest measures to make them still more efficient and useful for the pulse- economy. Thus, the study would provide a deep insight into different of pulse production in the study area. The study will be of great use to the policy maker's administrators, economists and extension workers for developing sound programmes and policies for the growth of pulse production in the study area.

**Objective of the Study:**

In view of the importance of pulse production and their impact on pulse economy of the state, the objectives envisaged for the study were as follows as given in synopsis:

**(I)** To study the growth and trend in area, production and productivity of pulse crops in study area.

**(II)** To measure the contribution of pulses in gross cropped area income employment on the selected holdings.

(III) To work out the costs and returns on major pulse crops and their competing crops sown in the study area.

(IV) To measure the resource use efficiency on various pulse crops production in the study area.

(V) To identify the constraints in production and productivity of pulse crops in the study area and suggest suitable remedial measures.

Chapter -II

# REVIEW OF LITERATURE

# REVIEW OF LITERATURE

In this chapter, an attempt has been made to review pertinent literature keeping in view the problem entitled "Production and productivity performance of pulses and their contribution in income and employment on farms in Chitrakoot Dham region of U.P. state." A brief account of the work reported by the past researcher has been discussed under the following heads:

1. Cropping pattern
2. Cost and returns
3. Annual compound growth rate in pulse production
4. Constraints in pulse production

**(1) Cropping Pattern:-**

**Sridharam, B. and Radhakrishnan, S. A. (1978)** concluded that through there is no shift in the cropping pattern between 1966-67 and 1976-77 in the Nilgiris district the acreage allocation between the crops is influenced by physical economic biological and sociological factors.

**Chopra, Kusum (1982)** revealed that in the states of increasing pulses, an increase in the cropping intensity leads to an increase in some of the Rabi pulses in Rajasthan and Madhya Pradesh.

**Acharya, S. S. (1985)** revealed that the pulse growing farms are characterized by larger size, low irrigated area and monocropping. Mixed cropping of pulses is predominant in the kharif season. The use of yield increasing inputs, especially fertilizers and plant protection measures, is negligible. It appears that there is a considerable technological lag in pulse production which calls for the manipulation of input – output prices in favour of pulse crops.

**Quazi, A. K. (1986)** resulted in a study that the cultivation has to be intensified and diversified to ensure an improved supply of food to the population. In this respect the emphasis is placed on the necessity not only to consider the various yield components but to concentrate on how far cropping system as a whole can be improved by the integration of higher potential legumes.

**Singh et al. (1988)** found that acreage under pulses has been decreasing in Himachal Pradesh. The declining trend in aerease was found in according with the in techno-economic conditions.

**Prasad, S.; Singh, V. P. N. and Singh, D. (1987)** reported that there is a need to modify the cropping pattern to increase to productivity per hectare.

**Singh, J. P.; Singh, O. N. and Singh, T. K. (1990)** suggested in their study that for the proper development of pulses production new crop sequences/intercropping systems are needed.

**Tuteja (1999)** resulted that the area under pulses got shifted to a large extent to wheat improved variety of pulses did not cover more than 33% of the area and inspire of lower adoption of improved seed and lower profits in production of pulses vis-à-vis competing crops resulted in high variability yield.

**(2) Cost and Returns :**

**Natarajan (1960)** found that fertilization of pulses with phosphate at the rate of 30 and 60 lbs/acre increases the yield as well as gives beneficial residue to the succeeding crop.

**Mann (1968)** reported that phosphate application to pulses not only benefits the particular crop but increase its yield and favour the effects on soil nitrogen content for the succeeding non-leguminous crops.

**Chandrawat et al. (1976)** reported that application of 15 kg N. + 30 Kg $P_2 O_5$ per hectare along with bacterial inoculation appreciably increased the yield of gram with substantial profit.

**Singh, D. (1977)** found 52 percent of the pulse growers sowed pulses on the recommended time and 47.8 percent sowed pulses either late or early there by reducing the yield of crop.

**Hegde, D. M. and Saraf, C. S. (1979)** indicated that the optimum dose of $P_2O_5$ and expected response increased with the increasing price of output at constant input cost and decreased with increasing cost of input at constant output value. The $P_2O_5$ utilization

efficiency was more sensitive to changes in input prices than the changes in output prices.

**Sharma, P. V. and Rao, T. K. (1979)** resulted that despite of high rise in the prices of pulses, the area under pulses has not risen, indicating no price response from 3 percent in each size unlike for chilies, groundnut and cotton.

**Raghuvanshi, C.S.; and Kumar, Rajendra and Ahmed, Tauseef (1982)** revealed that larger the volume milled, lower the cost and vice-versa. The B/C ratio was more than 3 percent in each size in the milling plants (i.e. large and small plants).

**Singh, Ved (1984)** explained that among the cultivation of maize, black gram (vigna mungo) cowpeas, red gram (Cajanus cajan) and groundnut under rain fed semi-arid conditions 1978-80, vigna mungo gave the highest net returns followed by Cajanus cajan.

**Sikdar, F. S. and Elias, S. M. (1985)** observed the study and investigates costs and returns of lentil cultivation in Bangladesh and explores the possibilities of expanding the area under crop.

**Singh, C. and Vashisth, A. K. (1985)** revealed that the producer's share in the consumer's rupee varied significantly from state to state. It was noted due to the different marketing systems.

**Catha and Singh (1985)** were of the opinion that while India had already reached near self-sufficiency in cereals there was

urgent need to improve the production of pulses to attain an immediate increase in the area under pulses crops with strong price incentives.

However, to establish production in the long run, a technological break-through is essential. The extension services also needed to be geared up and disseminate the favorable points of these crops.

**Uhlmann, P. (1986)** reported that the cost per hectare of subsidizing grain legumes [peas, E (1) 642.8, beans, E (1) 577.2] has been well above that of export restitutions on cereals (soft wheat E (1) 406.3, Barley E (1) 411.8).

**Muraleedharan, P. K. (1987)** revealed that the resource use efficiency in kole cultivation has been judged by comparing the estimated $MVP_S$ of various inputs with their respective factor costs. It appears that the cultivators have not been able to allocate their input efficiently and there seems to be considerable scope for augmenting profit from kole cultivation by optimum use of inputs.

**Chandra (1991)** reported that pulses have invariably been a weak commodity in the food grains production of the country. He stated that in the "bumper" harvest year 1988-89 pulses covered an area of 10.1 percent of all food grains and contributed 41.5 percent. Even the coarse cereals had higher productivity by about 38.5 percent than pulses.

## (3) Annual Compound Growth Rate in Pulse Production:

**Despande, R. S. and Chandrasekhar, H. (1982)** revealed that there are more cases where growth rates have declined with a higher magnitude in the case of area. The slow growth in production can be mainly attributed to stagnancy and decline with a higher magnitude in the case of area. The slow growth in production can be mainly attributed to stagnancy and declined in area. The supply response analysis indicates a positive response to real price of the crop and the yield.

**Grewal, P. S. and Bhullar, B. S. (1982)** explained that the production of pulses declined both in the pre-green revolution due to declining (rabi)/low (kharif) productivity and shrinkage in area whereas production showed little improvement in the past green revolution period due to increased area and productivity of gram. To identify the forces responsible for shrinkage in the area under pulses, a micro-level study was conducted. Highly significant growth rates in production and productivity were observed in the district of Thane, Ratnagiri, Ahmednagar and Pune in western Maharashtra.

**Singh, D. V. and Swarup, R. (1982)** concluded that the relative acreage under pulses has increased at the compound growth of 0.6 percent per annum while absolute area under all pulses grew at the compound rate of 0.8 percent per annum. However, the production and productivity declined at the rate of 0.6 and 1.6 percent.

**Kumar, A. (1986)** reported that there is wide gap between potential and average yields throughout India. While most states have

not been achieved the national average figure, a few have shown good productivity for a particular crop although the area under pluses in these state is quite low.

**Bagpat (1987)** revealed that the compound growth rates of area and production for gram were higher during 1975/76 – 1984/85 than in the pre IPDP period. The compound growth rates of area, production and productivity of Tur were negligible pre IPDP, but showed a significant increase during the negligible pre IPRD, but showed a significant increase during the post IPDP period about 25-35 percent of the respondents in this tribal district had used recommended seeds, seeding rate and rhizobium culture.

**Food and Agricultural Organization (1987)** reported that in the year 1970, production of pulses declined by almost 0.04 percent per annum, but in the year 1980 has increased by 4.0 percent per annum.

**Department of Agricultural Economics & Statistics (1987)** examined the trend of area, production and productivity of pulses along with competing crops in U.P. The dept. concluded that since the introduction of high yielding varieties of cereals after 1966-77 particularly wheat and paddy, there has been a shift in area of pulses to cereal crops.

## (4) Constraints in Pulse Production:

**Evaluation report (1959)** revealed that in all the areas and groups' lack of supply was the major reason for not using improved seeds.

**Singh, Y. P. (1973)** portrayed that only 12.0 percent of respondents were using irrigation in pulses. He further stated that lack of money, poor input – output ratio, lack of time; late maturity and small size of holding were the important reasons for non-adoption of pulses. Similar observations were found by **Khan (1975) and Ram (1975)**. He also reported that the least emphasis was given by farmers for improved varieties followed by use of fertilizer. 53.0 percent of the farmers were not using adequate quantity of seed for sowing the pulses and 50.0 percent of the crop was sown either late or early and never at an appropriate time.

**Mathur, Y. K. (1977)** reported that about a dozen insects, including pod borers, stem borers, leaf miners, foliage cutter pieces, jusside, aphid and white files are the most important that affect the kharif pulses.

**Mehrotra (1977)** revealed that estimates of losses due to weeds in pulses is about 15-20 percent depending upon the intensity of the weeds.

**Singh (1977)** also stated that availability of pesticides; fungicides and plant protection equipments were barrier in the control of diseases and pests. He also suggested that there should be a phased

Programme to replace local strains by improved varieties. Use of nitrogenous, phosphoric and bacterial fertilizers is necessary for increasing pulse production. Plant protection measures should be applied by the farmers to protect the crop from insect pests and diseases. Better pulse production technology should be provided to the pulse growers.

**Bhatnagar (1979)** noted that Government of Karnataka and Assam banned cultivation or sale of khesari or its products. The arrangements for credit for the purchase of inputs like seed, fertilizers and pesticides may be made through the co-operatives specially in areas where gram is grown exclusively i.e. in Bundelkhand region.

**Chatha, I. S. and Singh, J. (1986)** analyzed that the economic constraints that the economic constraints which hinder the growth of pulses and oil seeds in Punjab. The growth of pulses in the state over the period 1961-62 to 1970-71 and 1971-72 to 1980-81 was significantly negative and that of oil seeds positive but insignificant. Among the variables considered for regression analysis the productivity and price ratios were not significant. They suggested that strong price incentives are necessary for an immediate increase in the area under such crops.

**Marothia, D. K. (1986)** showed a positive association between adoption rates of improved inputs and profitability of the new wheat and gram technology. The results indicated the positive

correlation between irrigation facilities and use of growth promoting inputs and quality seeds.

**Nadkarni (1986)** reported that the growth of yield of coarse cereals has kept pace with that of food grains overall, but have lost relatively in area. Yields of pulses have been stagnant, but their fall in area is not so great. The major constraints affecting their growth is technological viz. their low yields and lower responsiveness to irrigation and fertilizers.

**Deptt. Of Agril. Eco. & Stats. (1987)** revealed that the growing traditional varieties of pulses on marginal and sub-marginal land, without irrigation and fertilization are supposed to be the major constraint in pulse production.

**Singh et. al. (1988)** found that acreage under pulses has been decreasing in Himachal Pradesh. Productivity of all pulses was observed to be far below the expected yield. The declining trend in acreage was found in accordance with the shifts in techno-economic conditions.

**Bhata (1991)** reported that the economic constraints of pulse production are the higher risks attached to the cultivation of the crop in rainfed areas and the rate of innovation adoption. The relationship between the prices of pulses and those for other staples is also a significant determination of the farmers supply. Hence, there must be a break-through in cultivation techniques and farm management in rainfed areas before the supply of pulses.

**Patel (1999)** reported that the constraints identified in the cultivation of pulses were the most of farmers lacked modern farm inputs with marginal variations in land owned and operated. Poor irrigation and the cultivation of a long duration cotton crop led to low cropping intensity and a change in cropping intensity and a change in cropping pattern in favour of crops. The productivity of pulses was low and its cost of cultivation was high as compared to other crops.

**Dwivedi, Akanchha, *et al.* (2002).** in Bundelkhand region it was noted that the lowest acreage fluctuation was found in case of gram (5.99%) as against the highest in case of urd (22.37%) followed by tur (12.22%). It is further inferred that wide fluctuation existed in production and yield of all the selected pulses. The production variability ranging from 18.89 percent in tur to 33.37 percent in case of yield the variability was almost similar in gram, tur and urd i.e. 16.32, 14.16 and 16.14 percent, respectively.

**Gangwal, L.S. (2002).** Observed that the prospects of pulses oilseeds and other coarse crops on tun irrigated farms depends on government price policy. The methodology followed for fixing of minimum support prices to the crop need to be modified. The pulses and oilseeds growers should get incentives so that they should be motivated for adoption of HYV seed, increase land allocation to these crops. For better transfer of technology and extension work it is necessary to give information about new innovations, through the farmer awareness camps, frontline demonstration, village meeting with members gram sabha, youth self help group.

**Gupta and Mishra (2002).** Reported that most of the dal mills relied on private traders and commission agents for the supply of pulse grains. It was generally observed that the gap between the prices received by the producers and paid by the consumers was significantly high. The benefit of price rise was not passed on either to producers or to consumers. Only private traders and dal mill owners enjoyed the benefits. The only way to benefit the pulse growers was to set up dal mills in the cooperative sector by the farmers cooperatives.

**Singh C.B. (2002).** It is implicative from the result that cost of processing of dal per quintal would be decreased it dal processing increase over a fixed period of item. In fact cost of the processing would be decreased so long as the increase in variable cost is perfectly offset by decrease in fixed cost, their by the efficiency of processing unit might be increased upto the level of existing installed capacity. In this regard, regular and long duration supply electricity the biggest existing constraints, could prove. Since the basic cause behind such a high processing cost is multiplicity of taxes, state government should review its purchase and sales tax policy to bring down this single unreasonably high cost component.

**Tuteja (2002).** Reported that production of pulses in Haryana between 1964-65 and 1995-96 has declined continuously. During the first two decades, production of total pulses has declined from 874 thousand tonnes in 1964-65 to 686 thousand tonnes in 1985-86. It further reduced to 451 thousand tonnes in 1995-96. Among pulses, the highest decline was observed in the case of gram.

Recently, other pulses occupied an important place in the production scenario of pulses by contributing 58 thousand tonnes to the total production of the state.

**Ali and Kumar (2004).** Find out that the major production constraints were non-availability of quality seeds of improved varieties in adequate quantity. Poor crop management and biotic and abiotic stresses besides socio-economic factors. Fusarium wilt is the most wides pred disease followed by sterility mosaic and phytophthora stem blight. Among key insect pests, helicoverpa pod borer and podfly cause severe damage to the crop among abiotic stress, water logging during vegetative stage, cold sensitivity during flowering stage, terminal drought during grain filing stage and salinity/alkalinity throughout the crop period inflict major yield losses and instability in production.

**Chahal S.S. *et al.* (2004).** The study reflects economic rationality in the part of pea growers as they were selling the produce to different buyers, seemingly depending upon the price elasticity of demand. Due to lack of necessary infrastructure, the farmers are forced to sell the entire produce during the post harvest season itself in spite of well anticipated decline in prices consequent upon increased market arrivals., The resource poor farmers, having small.

**Sankar *et al.* (2004)** reported that erratic rainfall and its distribution, damage due to inset pest and disease and non availability of improved seeds are the three constraints for low productivity of chickpea and pigeon pea. There is a great scope of increasing the yield of these two major pulses by adopting

appropriate soil and water conservation measures for efficient utilization of rain water, timely adoption of IPM and use of improved seeds.

**Sirohi P.S. *et al.* (2004)**. In case of lentil crop the area declined by 25.70, 11.30, 6.43, 5.37 and 4.60 thousand hectares in Kymore plateau of Satpura hills, central narmada valley, Northern Hill region of Chhattisgarh, Chhatigarh, plains and Satpura plateau but area increase in vidhyan plateau, grid region, malwa plateau, Bundelkhand region and Nimar valley by 35.43, 23.20, 3.33, 1.01 and 0.14 thousand hectares respectively. In term of relative changes the highest area increased was found in Grid region 108.86 percent followed by Vidhyan Plateau, Bundelkhand region, Malva Plateau and Nimar valley by 32.49, 30.00, 21.57 and 9.80 percent during the corresponding period. It is observed from the study that the area declined by 49.28, 41.48, 36.28, 36.02 and 31.32 percent in central Narmada Valley, Satpura plateau Chhatisgarh plains, Kymore plateau of Satpura Hills and Northern Hills region of Chhatigarh respectively.

**Dwivedi S.C. and M. L. Dwivedi (2006).** In Bundelkhand region the area, production and productivity of Urad registered an increase by 16.66 thousand ha with 94.82 percent, 6.83 thousand tones with 237.98 percent and 114.50 kg/ha with 68.53 percent. Area, production and productivity of Tur crop recorded increased by 4.73 thousand ha with 46.23 percent, 5.80 thousand tonnes with 138.10 percent and 287.13 kg/ha with 75.55 percent respectively.

**Singla, Rohit *et. al.* (2006).** Reported that cultivation of green pea was most profitable in Punjab. The yield of green pea was higher on small farms than medium and large farms. The costs incurred on seeds, FYM, zinc, hired labour & machinery percent, was higher on large farms but expenditure per hect. on fertilizer, animal labour, electricity/diesel and family labour was higher on small farms. The gross and net income per hect. was higher an large farmers. Fertilizer, irrigation and machinery influencing productivity of gram pea positively. The return over variable costs was found 129% higher than wheat crop.

**Tuteja Usha (2006).** Reported that the pre-economic reform period with 1.9 percent per annum growth in pulse production in India was far better than the post-reforms period with negative growth of 0.3 percent per annum. The tendency of slow growth in the production visible for total pulses at the all India level was also observed for individual pulses crops except massar. It emerged as the fastest growing crop in production due to area as well as yield growth. The empirical results on the extent of responsiveness of price and non-price factors to acreage of gram, arhar, moong, urad, massar and total pulses in India and major growing states varied widely in different milieu. The results revealed that acrease allocation in rabi pulses, i.e., gram and massar got influenced by lagged acreage followed by relative price in most of the analysed cases. This judgement however, does not apply to kharif pulses. In allocating land to arhar, moong and urad, farmers considered lagged acreage and magnitude of pre-sowing rainfall as the most important factors.

**Hypothesis:**

On the basis of objectives given under chapter one and the review of literature presented in this chapter. The following hypotheses were developed.

(1) There has been no growth or negative growth in area, production and productivity of pulses in the State.

(2) In district Chitrakoot division the growth in area, production and productivity has been positive.

(3) The cost and returns from pulses vary under different size groups.

(4) The production of pulses suffers from many constraints.

Chapter -III

# RESEARCH METHODOLOGY

The present chapter deals with methodology adopted in analysis and interpretation of the feelings of the problem entitled **"Production and productivity performance of pulses and their contribution in income and employment on farms in Chitrakoot Dham region of U.P. state."** The methodological aspects have broadly been discussed under the following five heads:

**(1)** Sampling Technique

**(2)** Method of enquiry and collection of data

**(3)** Period of enquiry

**(4)** Analytical tools and

**(5)** Limitation of the study.

**(1) Sampling Technique:**

A Multi-stage stratified random sampling technique used to select the district, block, cluster of villages and the respondents i.e. pulse growers:

**(i) Selection of Blocks:**

Out of 8 development blocks of district Chitrakoot Dham, two blocks namely "Kamasin" and "Jaspura" having more area under pulses were selected randomly.

**(ii) Selection of Villages:**

A list of all the falling under the selected blocks was prepared, out of which 10 villages i.e. 6 villages from Kamasin block and 4 from Jaspura block were selected randomly.

**(iii) Selection of the Respondents:**

A list of all the farmers i.e. pulse growers along with their cultivated area was prepared for each of the selected village. 100 pulse growers were selected randomly from the universe of 10 villages under three size groups, viz. below 2 ha.; 2-4 ha. and 4 ha. and above. The number of cultivators under each size group was kept in proportion to their total numbers falling under each village. The cultivators having 30 percent or more cropped area under pulses were treated as pulse growers.

Thus, the findings of the present study is based on a random sample of 100 pulse growers selected from the universe of 10 villages under three size groups, viz. below 2 ha, 2-4 ha. and 4 ha. and above from the blocks of district Chitrakoot Dham.

The number of cultivators selected from randomly from different villages under each size group.

**Table III-1: Number of pulse growers selected under different size groups from selected villages.**

| Sr. No. | Name of the block | Name of the selected village | Number of cultivators selected in different size group | | | Total |
|---|---|---|---|---|---|---|
| | | | 0-2 ha | 2-4 ha | 4 ha and above | |
| A | Kamasin : | | | | | |
| 1 | | Sandasami | 7 | 2 | 1 | 10 |
| 2 | | Pachhahan | 7 | 2 | 1 | 10 |
| 3 | | Mawaee | 6 | 2 | 1 | 9 |
| 4 | | Parsauli | 8 | 2 | 1 | 11 |
| 5 | | Bhati | 6 | 2 | 1 | 9 |
| 6 | | Biow | 8 | 2 | 1 | 11 |
| B | Jaspura : | | | | | |
| 1 | | Gajipur | 7 | 2 | 1 | 10 |
| 2 | | Warehata | 8 | 3 | 1 | 12 |
| 3 | | Sindham Khurd | 7 | 2 | 1 | 10 |
| 4 | | Gauri Khurd | 6 | 1 | 1 | 8 |
| | Total | | 70 | 20 | 10 | 100 |

## (2) Method of Enquiry and Collection of Data :

The enquiry was conducted by survey method. The primary data were collected by direct personal interview with the responds. The data were obtained on well prepared schedules and questionnaires made for the purpose of present enquiry. Three to four visits were made to collect the information. The information so collected was duly verified with the village leaders, village level officers, progressive farmers etc.

The secondary data were obtained from the district and block headquarters and published materials.

**(3) Period of Enquiry:**

The enquiry was conducted during the agricultural year 2001-2002 covering all the agricultural seasons. It extended from 1st July, 2001 to 30th June, 2002.

**(4) Analytical Tools:**

The following analytical tools were adopted for the analysis of the present problem:

**(i) Farm Business Analysis :**

This includes the detailed analysis of costs and returns of the individual crop enterprise as well as the farm as a whole. The various measures used for the analysis included.

**(a) Total input :**

It includes all the cash and kind expenses as detailed below:

**(i)** Wages of hired labour paid in cash or kind.

**(ii)** Imputed wages for the farmer and his family used in crop and livestock production.

**(iii)** Value of seed, manure and fertilizers and other cash expenses.

**(iv)** Cost of feed, fodder and concentrates.

**(v)** Repairs to dead stock.

**(vi)** Depreciation on dead stock and live stocks.

**(vii)** Interest on fixed and working capital.

(viii) Rent of land whether rented or owned.

(ix) Irrigation charges.

**(b) Total Output :**

The quantity of product produced for different a crops and livestock enterprise was treated as the total output. When the output is multiplied by its price then it is the output value.

**(c) Net Profit :**

It is the difference between total receipts and total expenses. It includes the pay of the farm manager and interest on capital invested in the business. It was calculated as :

Net income = Gross income – total expenses.

**(d) Family Labour Income :**

It includes net income or loss plus imputed value of wages for the labour of farmer and his family.

**(e) Farm Business Income :**

It is the gross income minus total expenses of production excluding wages of the family labour, interest on owned capital and rental value of land. It is a measure of the earnings of a farmer and his family for their capital investment, labour and managerial work. It can be expressed as :

F.B.I. = Family labour income + interest on working capital+ Rental value of land.

**(f) Input – Output Ratio :**

It can be expressed as the ratio of output to input. The ratio was calculated as :

$$\text{I/O ratio} = \frac{O}{I}$$

Where,

I = Total input,

O= Total output.

**(g) Cost of Production Per Quintal :**

It refers to total input cost divided by output value and then multiplying by the respective prices of main and by-product.

**(h) Cost Concept :**

The cost of production of pulses has been presented in terms of cost A, cost B and cost C. The new cost concepts are given below:

**Allocation of Joint Cost:**

Incase of mixed cropping the cost of various operation jointly. For the sake economic analysis of individual crops, the joint cost has been allocated among the various mixed crops in proportion to the gross income obtained by the same crops.

**(i) Cost A:**

Labour, charges for both hired and owned bullock labour, charges of both hired and owned and tractor power, this included all the

cash and kind expenses actually incurred by the owner cultivator. These are charges for hired human cost of seed, manures and fertilizer, plant protection, miscellaneous costs, land revenue and cess, depreciation charges and interest on working capital (on only paid out costs).

**(ii) Cost B :**

This is cost $A_1$ plus rental value of owned land and interest on owned fixed capital (including land).

**(iii) Cost C :**

This is cost B plus imputed value of family labour. It is commercial cost of production.

**(II) Tabular Analysis :**

Tabular analysis was used to compare the values of costs, returns and cost of production of crops of different size groups.

**(III) Averages :**

The average given in the present study relates to the weighted average. The following formula was used for calculating the weighted average of different items:

Weighted average

Or $$= \frac{W_1X_1 + W_2X_2 + - - - W_nX_n}{W_1 + W_2 + - - - W_2}$$

Weighted mean

$$\text{Weighted average} = \frac{\Sigma WX}{\Sigma W}$$

Where,

X = Weighted value of an item.

W = Weight of X.

$\sum W = N$ = Total value of weight.

**(IV) Production Function Analysis :**

Production function analysis was carried out to examine the productivity and efficiency of different resources used in the process of production on the sample pulse growing farms. Multiple regression analysis was done to examine the cost-benefit relationship and productivity of farm inputs on pulse crop.

The production function equations; viz. Cobb-Douglas, linear and quadratic were tried. Cobb-Douglas type of production function was finally fitted. Because of the higher $R^2$ value obtained, adequate fit of the data and computational feasibility in the Cobb-Douglas type of production function, this form was finally retained for economic analysis, eliminating the other two farms; viz. linear and quadratic types of production functions, from the findings. An additional advantage of this type of function was the information which it provided in respect of returns, to scale in farming operation. The Cobb-Douglas type of production function took the form of:

$$Y = a X_1^{b} 1 X_2^{b} 2 --- X_n^{b} n$$

Where,

Y = Department variable

(Output values in rupees/hectare)

$X_i$ = $_i$th independent variable

(Input values in rupees/hectare)

a = Constant

$b_i$ = $_i$th production elasticity with respect to $X_i$.

The values of the constant (a) and coefficients ($b_i$) in respect of independent variables in the function have been estimated by using the method of least squares.

**(V) Estimation of Marginal Value Product :**

The marginal value product of inputs was estimated by taking partial derivates of returns with respect to the input concerned, at the geometric level of the inputs. The steps involved for the estimation of marginal value product of inputs have been delt with in Chapter VI. The marginal value product was calculated by using the formula as :

$$(MVP)_i = b_i \frac{Y}{X_i}$$

Where,

$b_i$ = Production elasticity with respect to $X_i$

Y = Geometric mean of Y.

(output values in rupees/hectare).

$X_i$ = Geometric mean value of $X_i$

(input values in rupees/hectare).

**(VI) Estimation of Optimal Levels of Inputs and Returns :**

To suggest the resource adjustment, optimal levels of various inputs with the existing capital have been calculated with the help of following equation :

$$X_i \text{ (Optimum level)} = \frac{b_i}{\Sigma_i b_i} . C$$

Where,

C = Capital (sum of geometric means of all inputs), and the remaining symbols have their usual meanings.

**(VII) Compound Growth Rate :**

Annual compound growth rates in area, production and productivity of pulses were worked out in the state of Utter Pradesh as well as in district Chitrakoot Dham by fitting an exponential function of the following form was used :

$$Y = A\ B^t$$

$$\log Y = \log A + t \log B.$$

Where,

Y = area/production/productivity

A = constant

B = regression coefficient

t = time in years.

Compound growth rate = (Anti-log of B-1) 100

## (6) Limitation of the study :

During the course of investigation several difficulties were faced in the collection of data from cultivators. The cultivators generally did not maintain any farm record and supply the data on the basis of their memory which may not be very correct. The illiteracy of the farmers also added to this problem. Some of the farmers did not co-operate in giving data because of some misunderstanding regarding agricultural taxes, ceiling etc. They were biased in giving data towards higher side for the investment and lower side towards productivity. However, sufficient care was taken to collect correct data by cross checking with the educated neighbouring farmers and other village leaders, gram pradhans etc.

Chapter - IV

# AGRO-ECONOMIC FEATURES OF THE TRACT

# AGRO-ECONOMIC FEATURES OF THE TRACT

## Agro-Economic Feature of the Study Area District Chitrakoot Dham:

**Location –**

District Chitrakoot Dham comprises an caste rely most tract of board Chitrakoot region of U.P. which has principally developed from the Vindhyan rock system extended into this state from the adjoining Vindhyan area of Madhya Pradesh. The district is located between latitudes of 24° 53° and 25° 55° north and the longitudes of 67° 59° and 81° 34° east. To the south east of Chitrakoot Dham district, there are Satna and Revan districts of Madhya Pradesh and in the west are the Mahoba and Maudaha tehsils of Hamirpur district. In the north and north east across the Yamuna, it is bounded with Fatehpur and Allahabad district. In the south across the river Ken, Panna and Chhatarpur districts of Madhya Pradesh are situated. There are four tehsils and 8 development blocks in the district.

It has a geographical area of 411420 ha and is separated from the remaining district of Chitrakoot by the very important river known as Ken which flows from south-north in the rather regular course.

Although, the district is bounded by two rivers, the Ken and Yamuna, a significant position of the land also lies across the Ken River in its north and a Trans Ken portion of Banda tehsil in its west. The district has attained the shape of a quadrilateral with its extreme west-cast length of about 160 and breadth from north averaging about 60 km.

**Topography –**

The land scape of the area is mainly a level plain, with the exception of Vindhyan hill system which are concentrated mainly in the south and south-east portion of the district. Beside, the two major rivers, two important rivers lets viz. Baghain and Paisuni, both of which also flowing in the district in a south – north easterly direction has also greatly modified the land scape of the district. In fact Baghain River intersects the district into two separate portions that lying to south of this river, constituting mainly the Vindhyan table lands. The intermediate area between the river Baghain and table land again comprises leveled plains of this district. Based on these generalized distribution of district could be broadly divided into two natural divisions which have been recognized even locally since time immemorial. These two portions could be grouped as up lands and low lands. The farmer is known as Parwa and local parlance and occurs in the north and the latter named as alluviums of Yamuna which overly the extensive gneissic rock of system of Vindhyan table land mainly in the southern half of the district.

**Soil –**

The bulk of district consists to four types of soil viz. Mar, Kabar, Parwa and Rakar, which are having their own characteristics. Mar is blacky –clayey and too much fertile and much water holding capacity. It is suitable for growing Rabi crops. Kabar and Parwa are the slight sandy loam soils suitable for Rabi and kharif crops. Rakar is the inferior quality of land but on whole the soil differ from area of the district.

**Climate –**

The climate of the district is one of the usual patterns of Chitrakoot region, with extremes of aridity in the dry months and cold during winters. Dry months of March to June are extremely hot, the temperature at time shooting as high as 50° C. Nights are however cool. The mansoon months of July to September are moist and the atmosphere is full of humidity. Due to the coarse nature of the soil and the rapid percolation rate, rain water disappears in the ground. Winters are cold with very little rainfall during these months.

**Rainfall –**

The normal annual rainfall of the district is about 90 cm. It varies from 40 to 100 cm. The mansoon is irregular, uncertain and ill distributed throughout the year. The erratic nature of rainfall creates much difficulty in growing crops. More than 80 percent of the precipitation takes place during 3 months of mansoon season, extending from last week of June to the end of September.

**Irrigation –**

The source-wise irrigated area in district Chitrakoot Dham has been shown in Table IV-1.

**Table IV-1: Irrigation by different sources in district Chitrakoot Dham.**

| Sr.no. | Source of irrigation | area in hectare | Percentage |
|---|---|---|---|
| 1 | Cannel | 64280 | 69.71 |
| 2 | Govt. Tube-well | 15659 | 16.98 |
| 3 | Private Tube-wells | 5772 | 6.26 |
| 4 | Ponds and lakes | 1216 | 1.32 |
| 5 | Other sources | 5286 | 5.73 |
| Total | | 92213 | 100.00 |
| Percentage of irrigated area to total cultivated area | | | 18.18 |

Table IV-1, reveals that the main source of irrigation in district Chitrakoot Dham is canal, which accounted 69.71 percent of the total irrigated area. Next to it was Govt. Tube-well which commanded 16.98 percent of the total irrigated area of the district. The other sources of irrigation the private tube-wells, ponds and lakes and other source of irrigation covered 6.25 percent, 1.32 percent and 5.73 percent of the net irrigated area of the district respectively. The percentage irrigated area in the district is very low being only 18.18 percent.

**Land utilization of district Chitrakoot Dham –**

The pattern of land utilization of district Chitrakoot Dham is shown in Table IV-2.

Table IV-2 shows that total reported area of district Chitrakoot Dham was 790026 hectare. Area under forest, agrl. Barren land, current fallow, other fallow, usar and uncultivated land, orchard permanent pasture, miscellaneous and net sown area were 9.85, 4.47, 6.12, 3.74, 4.83, 1.12, 0.05, 0.62 and 64.20 percent, respectively. The net area sown of district is quite high and there is very limited scope for extending area under cultivation. Therefore, the only alternative to increase the agricultural production in the district is by adopting intensive agricultural practices.

**Table IV-2: Pattern of land utilization of Chitrakoot Dham district.**

| Sr. No. | Particular | Area in hectare | Percentage to total reported area |
|---|---|---|---|
| 1 | Net area sown | 507220 | 64.20 |
| 2 | Forest | 77782 | 9.85 |
| 3 | Agril barren land | 35333 | 4.47 |
| 4 | Current fallow | 48405 | 6.12 |
| 5 | Other fallow | 29513 | 3.74 |
| 6 | Usar and uncultivated land | 38158 | 4.83 |
| 7 | Orchard | 8838 | 1.12 |
| 8 | Permanent pasture | 380 | 0.05 |
| 9 | Miscellaneous | 44397 | 5.62 |
| 10 | Area sown more than one | 118690 | 15.02 |
| 11 | Total cropped area | 625910 | 79.23 |
| 12 | Cropping intensity | - | 123.40 |
| Total reported area | | 790026 | 100.00 |

**Administrative divisions –**

Chitrakoot Dham district is divided into five tehsils viz. Banda, Baberu, Naraini, Karvi and Mau. There are three municipalities and six town areas. It has got 1207 revenue villages and its rural population is 87.00 percent. There are 13 community development blocks in district Banda. The district headquarter is located in Banda municipal area. The tehsil wise number of blocks and villages are given in Table IV-3.

**Table IV-3: Distribution of number of villages in each block and tehsil of district Chitrakoot Dham.**

| Sr. No. | Name of Tehsil | Name of Block | No. of villages in each block | No. of villages in each tehsil |
|---|---|---|---|---|
| 1 | Baberu | Baberu | 86 | 213 |
| | | Kamasin | 74 | |
| | | Bisanda | 53 | |
| 2 | Banda | Jaspura | 43 | 209 |
| | | Tindwari | 84 | |
| | | Badokhar Khurd | 82 | |
| 3 | Naraini | Naraini | 158 | 292 |
| | | Mohuwa | 134 | |
| 4 | Attara | Attara | 128 | 290 |
| | | Sumerpur | 162 | |

Source: Office of the Statistics Officer, Chitrakoot Dham.

**Crops –**

The main crops grown in the district are given below.

**Kharif Season:**

Paddy, Jowar, Arhar, Bajra, Moong, Urd, Sunhemp, Small millens etc.

**Ravi Season:**

Wheat, Gram, Barley, Lentil, Mustard etc.

**Zaid Season:**

Moong, Urd and summer vegetables.

**Cropping pattern:**

The area under different crops in the district Chitrakoot Dham has been given in Table IV-4.

**Table IV-4: Distribution of cropped area under different crops in district Chitrakoot Dham (1999-2000).**

| Sr. No. | Crops | Area in hectare | Percentage to total cropped area |
|---|---|---|---|
| 1. | Cereal crops : | | |
| | Paddy | 91301 | 14.59 |
| | Jowar | 72724 | 11.62 |
| | Bajra | 12035 | 1.92 |
| | Wheat | 190480 | 30.43 |
| | Barley | 12182 | 1.95 |
| | Maize | 12 | 0.01 |
| Total | | 378735 | 60.50 |
| 2. | Pulses : | | |
| | Arhar | 44696 | 7.14 |

**Continue.....**

| | | | |
|---|---|---|---|
| | Pea | 468 | 0.07 |
| | Lentil | 19027 | 3.04 |
| | Moong | 547 | 0.09 |
| | Urd | 1165 | 0.19 |
| | Gram | 167339 | 26.74 |
| | Soyabean | 317 | 0.05 |
| Total | | 233559 | 37.32 |
| 3. | Commercial Crops: | | |
| | Lahi and Sarson | 2337 | 0.37 |
| | Linseed | 6072 | 0.97 |
| | Till | 1869 | 0.30 |
| | Gestor | 75 | 0.01 |
| | Groundnut | 54 | 0.01 |
| | Sugarcane | 997 | 0.16 |
| | Potato | 259 | 0.04 |
| | Tobacco | 74 | 0.01 |
| | Sunhemp | 1879 | 0.31 |
| Total | | 13616 | 2.18 |
| Grand Total | | 625910 | 100.00 |

Table IV-4, reveals that the main crops in the district were wheat, gram, paddy, Jowar, arhar and lentil. Out of the total cropped area of 625910 hectares, wheat, gram, paddy, Jowar, arhar and lentil accounted for 190480 hectares, 167339 hectares, 91301 hectares, 72724 hectares, 44696 hectares, and 19027 hectares, respective.

**Major crop rotations:**

The following major crops rotations were followed in district Chitrakoot Dham.

**[1] One year crop rotations –**

Paddy – Wheat,

Paddy - Gram,

Follow – Wheat + Gram + Linseed and Mustard.

Jowar + Arhar + Moong

Jowar + Arhar + Urd

Jowar (Fodder) – Wheat

Till + Arhar,

Paddy – Wheat – Moong

**[2] Two years crop rotations –**

Jowar + Arhar – fallow – Gram

Till + Arhar – fallow – Wheat

Paddy – Wheat – Sarson – Gram

**Description of the block –**

Block Kamasin selected for the present study is located on Chitrakoot Dham – Rajapur route whereas the Jaspura block on Chitrakoot Dham – Hamirpur route in tehsil Baberu and Chitrakoot Dham of the district. The headquarters of block Kamasin and Jaspura are about 58 km and 40 km away from district headquarters, respectively. Block Kamasin is bounded by river Yamuna in north; Baberu in west, Jaspura is bounded by Tindwari in east, Hamirpur in west and Badokhar Khund in south-east. There are 84 villages and 82

villages in block Kamasin and Jaspura respectively according to the census of 2001.

**Climate –**

The climate of the selected blocks is sub-tropical having three district seasons, viz. rainy season, winter season and summer season. The temperature in summer rises as high as 48° C and it goes down in winter to 4-5° C.

**Rainfall –**

Most of the rainfall occurs during the year, in the month of June to October i.e. in rainy season. The average rainfall of the selected blocks is 98 cm per annum (based on the average of 10 years).

**Soils –**

Soils of the blocks are similar to that of district Chitrakoot Dham i.e. Mar, Kabur, Parwa and Roks.

**Topography –**

Generally most of the area consisted of even topography having very little up and down trend. The slope of the blocks is generally from south to north – east.

**Land utilization pattern –**

The pattern of land utilization during the year 1999-2000 of Kamasin and Jaspura blocks is given in Table IV-5.

**Table IV-5: The land utilization pattern of block Kamasin and Jaspura Khurd during the year 1999-2000 (in hectares).**

| Sr. No. | Particular | Kamasin | Jaspura |
|---|---|---|---|
| 1 | Reported area | 52101 | 35926 |
| 2 | Forest | N.A. | 167 |
| 3 | Agriculture | 1720 | 1003 |
| 4 | Current fallow | 5252 | 1758 |
| 5 | Other fallow | 3273 | 289 |
| 6 | Usar and uncultivated land | 673 | 1122 |
| 7 | Land other than argil. Use | 2999 | 2389 |
| 8 | Pasture | 8 | 27 |
| 9 | Orchard | 125 | 119 |
| 10 | Net cultivated area | 38051 | 29052 |
| 11 | Area sown more than one | 7010 | 1453 |
| 12 | Total cropped area | 45061 | 30505 |

Note: Figures in parentheses show the percentage to their respective total.

Source: Statistical Bulletin of District Chitrakoot Dham, 2001.

Table IV-5, reveals that the cultivated area of block Jaspura had the higher percentage being 80.86 to total reported area of the block against 73.03 percent in block Kamasin. The pattern of land utilization of the blocks suggested that there is no scope of bringing more block and 47.30 percent in Kamasin block. Source wise imigated area in Kamasin and Jaspura blocks was 2229 hect. & nil by canal 421 hect. & 1576 hect. By Govt. Tube well, 2251 hect. 720 hect. by private tube wells and 748 hect. & 170 by other source of inflation respectively.

**Cropping pattern –**

The pattern of growing crops in blocks Tindwari and Badokhar Khurd, district Chitrakoot Dham is given in table IIV-7.

**Table IV-7: Cropping pattern of the blocks (in hectares) year 1999-2000.**

| Sr. No. | Crop | Kamasin | Jaspura |
|---|---|---|---|
| 1 | Cereal crops | | |
| | Paddy | 2538 | 3 |
| | Wheat | 11340 | 6256 |
| | Barley | 443 | 52 |
| | Jowar | 4767 | 5336 |
| | Bajra | 1458 | 627 |
| | Sub-total | 20546 | 12274 |
| 2 | Pulses | | |
| | Urd | 225 | 811 |
| | Moong | 181 | 73 |
| | Lentil | 5377 | 1661 |
| | Gram | 14164 | 12510 |
| | Arhar | 2111 | 1961 |
| | Sub total | 22058 | 16016 |
| 3 | Commercial crops | | |
| | Mustard | 243 | 293 |
| | Linseed | 420 | 190 |
| | Other oil seeds | 306 | 102 |
| | Sub total | 969 | 1585 |
| 4 | Cash crops | | |
| | Sugarcane | 43 | 5 |
| | Potato | 21 | 3 |
| | Sub total | 64 | 8 |
| Total cropped area | | 43637 (100.00) | 29883 (100.00) |

Source: Statistical bulletin of district Chitrakoot Dham, 2001.

Note: Figure in parentheses show the percentage to their respective total.

**Major Crop Rotation –**

The following were the major crop rotations followed in two blocks under study:

**(1)** Fallow – wheat + Gram

**(2)** Jower + Arhar + Urd

**(3)** Fallow – Gram + Mustard + Linseed

**(4)** Lentil + Mustard + Linseed

**(5)** Paddy – Wheat

**(6)** Jowar + Arhar + Fallow – Gram

**(7)** Paddy – Gram – Fallow – Wheat

**Average yield –**

The average yield of important crops given in the district during the year 1999-2000 shown in table IV-8.

Table IV-8 shows that the average yield of wheat crop in district Chitrakoot Dham during the year 1999-2000 quintals per hectare that of paddy 13.32 q., maize 7.21 q., moong 2.45 q., gram 7.60 q., pea 12.24 q., arhar 21.29 q., potato 225.36 q. and soyabean 7.85 q.

**Table IV-8: Average yield of important crops during the year (1999-2000).**

| Sr. No. | Crop | Yield in Q:1./Hectare |
|---|---|---|
| 1 | Paddy | 13.32 |
| 2 | Maize | 7.21 |
| 3 | Jowar | 8.57 |
| 4 | Bajra | 4.32 |
| 5 | Wheat | 15.51 |
| 6 | Barley | 16.75 |
| 7 | Urd | 3.25 |
| 8 | Moong | 2.45 |
| 9 | Lentil | 7.11 |
| 10 | Gram | 7.60 |
| 11 | Pea | 12.24 |
| 12 | Arhar | 21.29 |
| 13 | Linseed | 5.10 |
| 14 | Sugarcane | - |
| 15 | Groundnut | 6.22 |
| 16 | Tobacco | 50.00 |
| 17 | Sunhemp | 13.02 |
| 18 | Potato | 225.36 |
| 19 | Soyabean | 7.85 |

Source : Statistical bulletin of district Chitrakoot Dham, 2001.

Chapter - V

# GROWTH IN AREA, PRODUCTION AND PRODUCTIVITY OF PULSES

# GROWTH IN AREA, PRODUCTION AND PRODUCTIVITY OF PULSES

Pulses constitute the most important source of protein in the diet of an average Indian. These are grown throughout the country and help in maintaining and improving the fertility of soil as they help in fixation of nitrogen in the soil. With the growing population and realization of the role of pulses at a rate much faster than that of cereals.

In this section an attempt has been made to study the growth rates of area, production and productivity of various pulses in the study area as well as in the study of Uttar Pradesh.

**Growth in Area, Production and Productivity in U.P.:**

The growth rate of area, production and productivity of total pulses in Uttar Pradesh has been presented in Table V-1.

Table V-1, indicates that the overall area under total pulses has shown a decreasing trend at the rate of -1.01 percent per annum in Uttar Pradesh with effect from 1980-81 to 1999-2000. As regards the production, it declined from 3069.26 thousand tonnes to 2412.73 thousand tonnes during the period 1980-81 to 1999-2000. It's compound growth rate was workout to -0.11 percent per annum. Likewise average yield declined from 8.24q/ha. to 8.08q/ha. during the

aforesaid period. The compound growth rate of average yield was worked out to (+) 1.47 percent per annum.

**Table V-1: Growth rates of area, production and productivity of total pulses in U.P. during the period 1980-81 to 1999-2000.**

| Sr. No. | Year | Area (In 000 ha.) | Production (In 000 t.) | Productivity (q. /ha.) |
|---|---|---|---|---|
| 1 | 1980-81 | 3724.83 | 3069.26 | 8.24 |
| 2 | 1981-82 | 3524.66 | 2919.91 | 8.28 |
| 3 | 1982-83 | 3707.41 | 2922.31 | 8.33 |
| 4 | 1983-84 | 3476.84 | 1849.56 | 5.32 |
| 5 | 1984-85 | 3149.44 | 2184.89 | 6.94 |
| 6 | 1985-86 | 3155.35 | 2656.72 | 3.42 |
| 7 | 1986-87 | 3048.03 | 2628.81 | 8.62 |
| 8 | 1987-88 | 2989.06 | 2420.89 | 8.10 |
| 9 | 1988-89 | 3103.53 | 2364.62 | 7.62 |
| 10 | 1989-90 | 2941.59 | 1555.69 | 5.29 |
| 11 | 1990-91 | 2859.31 | 2526.43 | 8.84 |
| 12 | 1991-92 | 3046.64 | 2556.67 | 7.44 |
| 13 | 1992-93 | 2979.10 | 2267.75 | 8.58 |
| 14 | 1993-94 | 2832.22 | 2498.83 | 8.82 |
| 15 | 1994-95 | 2888.26 | 2705.03 | 9.36 |
| 16 | 1995-96 | 3171.13 | 2831.61 | 8.93 |
| 17 | 1996-97 | 3110.55 | 2665.71 | 8.57 |
| 18 | 1997-98 | 2976.83 | 2361.79 | 7.93 |
| 19 | 1998-99 | 2923.11 | 2662.64 | 9.11 |
| 20 | 1999-00 | 2986.05 | 2412.73 | 8.08 |
| | C.G.R. | -1.01 | -0.11 | +1.47 |

Source: Agriculture in brief in U.P., 2001.

**Growth in Area, Production and Productivity of URD:**

The growth in area, production and productivity of URD in district Chitrakoot Dham region of Uttar Pradesh with effect from 1980-81 to 1999-2000 are given in Table V-2.

Table V-2, shows that the area under Urd in Chitrakoot Dham district increased from 441 hectares to 1089 hectares during the period 1980-81 to 1999-2000. It's growth rate was worked out to (+) 5.25 percent per annum. The production under Urd in the district rose from 187 metric tonnes to 269 metric tonnes during the period under study and had a positive growth rate of (+) 2.21 percent per annum. The productivity of Urd in the district declined from 4.24q/ha. to 2.47q/ha. during the period 1980-81 to 1999-2000.

Regarding the area and production of Urd in Chitrakoot Dham division, both of them increased from 13139 hectares and 51512 metric tonnes, respectively during the year 1980-81 to 54202 hectares and 62265 metric tonnes, respectively during the year 1999-2000. The annual compound growth rates of area and production during the aforesaid period were worked out to (+) 8.40 percent and (+) 0.62 percent, respectively. The average yield per hectare of Urd did not show much increase rather it sometimes declined. It's annual compound growth rate came to (+) 1.47 percent during the period 1980-81 to 1999-2000.

**Table V-2: Growth in area, production and productivity of Urd in district Chitrakoot Dham region of Uttar Pradesh during the period 1980-81 to 1999-2000.**

| Sr. No. | Year | Banda District | | | Chitrakoot Dham Division | | | Uttar Pradesh | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Area | Production | Productivity | Area | Production | Productivity | Area | Production | Productivity |
| 1 | 1980-81 | 441 | 187 | 4.24 | 13139 | 51512 | 4.24 | 151653 | 51512 | 3.33 |
| 2 | 1981-82 | 368 | 105 | 2.86 | 12297 | 28959 | 2.86 | 145828 | 28959 | 1.98 |
| 3 | 1982-83 | 601 | 190 | 3.16 | 17017 | 63270 | 2.81 | 169866 | 63270 | 3.72 |
| 4 | 1883-84 | 680 | 342 | 5.04 | 18995 | 62095 | 4.77 | 164188 | 62095 | 3.73 |
| 5 | 1984-85 | 673 | 251 | 3.73 | 19721 | 45180 | 2.29 | 1721120 | 1009589 | 5.87 |
| 6 | 1985-86 | 628 | 144 | 1.99 | 15717 | 42936 | 2.39 | 145610 | 42936 | 2.95 |
| 7 | 1986-87 | 422 | 123 | 3.41 | 14850 | 38622 | 3.36 | 133833 | 38622 | 2.89 |
| 8 | 1987-88 | 606 | 88 | 2.02 | 16379 | 54959 | 2.33 | 148122 | 54959 | 3.71 |
| 9 | 1988-89 | 749 | 35 | 1.18 | 23533 | 42763 | 1.16 | 174242 | 42763 | 2.45 |
| 10 | 1989-90 | 568 | 126 | 0.61 | 31579 | 33246 | 0.43 | 204001 | 33246 | 1.63 |
| 11 | 1990-91 | 532 | 232 | 2.37 | 30785 | 55011 | 2.11 | 200175 | 55011 | 2.75 |
| 12 | 1991-92 | 639 | 108 | 3.63 | 34049 | 72166 | 2.57 | 227022 | 72166 | 3.18 |
| 13 | 1992-93 | 574 | 158 | 1.88 | 27235 | 47628 | 1.38 | 188282 | 47628 | 2.53 |
| 14 | 1993-94 | 745 | 271 | 2.12 | 35194 | 43694 | 2.33 | 188388 | 43694 | 2.32 |
| 15 | 1994-95 | 839 | 351 | 3.23 | 40399 | 52624 | 3.26 | 188477 | 52624 | 2.79 |
| 16 | 1995-96 | 1139 | 170 | 3.15 | 51331 | 51410 | 3.03 | 209316 | 51410 | 2.46 |
| 17 | 1996-97 | 1165 | 241 | 1.46 | 47094 | 51740 | 1.31 | 202080 | 51740 | 2.56 |
| 18 | 1997-98 | 728 | 253 | 3.31 | 51571 | 58838 | 3.19 | 198569 | 58838 | 2.96 |
| 19 | 1998-99 | 1016 | 279 | 2.75 | 49427 | 69717 | 2.95 | 201284 | 69717 | 3.46 |
| 20 | 1999-00 | 1089 | 269 | 2.47 | 54202 | 62265 | 2.67 | 211067 | 62265 | 2.95 |
| C.G.R. | | +5.25 | +2.71 | +1.72 | +8.40 | +0.62 | +1.47 | +0.22 | +1.02 | +1.0008 |

Source: Krishi Bhavan, U.P., 2001.

Area: in hectare; production: in m.t.; productivity : in q/ha.

The area under Urd in Uttar Pradesh as a whole did not show tremendous increase rather it some time declined. The area increased from 151653 hectares in 1980-81 to 211067 hectares in 1999-2000. Likewise the production increased from 51512 metric tonnes to 62265 metric tonnes during the period 1980-81 to 1999-2000. The annual compound growth rates of area and production of Urd in Uttar Pradesh were worked out to (+) 0.22 percent and (+) 1.02 percent, respectively during the aforesaid period. Productivity also did not show much increase. It was worked out to (+) 1.0008 percent per annum.

**Growth in Area, Production and Productivity of Moong:**

The annual compound growth rates in area, production and productivity of Moong in district Chitrakoot Dham region of Uttar Pradesh during the period 1980-18 to 1999-2000 have been given in Table V-3.

Table V-3, portrays that the area and production of moong in Chitrakoot Dham district during the period 1980-81 to 1999-2000 showed a tremendous increase. Area and production increased from 50 hectares and 14 metric tonnes, respectively during 1980-81 to 685 hectares and 155 metric tonnes, respectively during 1999-2000. Their annual compound growth rates were calculated at (+) 7.3 percent and (+) 20.06 percent, respectively. Average yield declined from 2.73q/ha to 2.26q/ha with an annual compound growth rate of (+) 1.74 percent.

**Table V-3: Growth in area, production and productivity of Moong in district Chitrakoot Dham region of Uttar Pradesh during the period 1980-81 to 1999-2000.**

| Sr. No. | Year | Banda district | | | Chitrakoot Dham division | | | Uttar Pradesh | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Area | Production | Productivity | Area | Production | Productivity | Area | Production | Productivity |
| 1 | 1980-81 | 50 | 14 | 2.73 | 2098 | 495 | 2.36 | 13242 | 3806 | 2.60 |
| 2 | 1981-82 | 34 | 7 | 1.92 | 1641 | 316 | 1.92 | 11791 | 2512 | 2.13 |
| 3 | 1982-83 | 37 | 9 | 2.43 | 1716 | 297 | 1.73 | 13092 | 2409 | 1.84 |
| 4 | 1983-84 | 14 | 3 | 2.41 | 1943 | 314 | 1.61 | 15506 | 3586 | 2.47 |
| 5 | 1984-85 | 80 | 12 | 1.50 | 2004 | 407 | 2.03 | 14012 | 3307 | 2.36 |
| 6 | 1985-86 | 1692 | 10 | 0.61 | 2921 | 485 | 1.66 | 16206 | 4802 | 2.96 |
| 7 | 1986-87 | 160 | 24 | 1.50 | 2972 | 722 | 2.43 | 16821 | 4960 | 2.95 |
| 8 | 1987-88 | 118 | 23 | 1.95 | 2960 | 604 | 2.04 | 16979 | 5605 | 3.30 |
| 9 | 1988-89 | 124 | 4 | 0.31 | 3193 | 287 | 0.90 | 16007 | 3028 | 1.89 |
| 10 | 1989-90 | 127 | 1 | 0.03 | 3333 | 33 | 0.10 | 16356 | 2246 | 1.37 |
| 11 | 1990-91 | 204 | 27 | 1.34 | 4641 | 1035 | 2.23 | 17954 | 3697 | 2.06 |
| 12 | 1991-92 | 246 | 10 | 0.42 | 4997 | 365 | 0.73 | 19355 | 4414 | 2.28 |
| 13 | 1992-93 | 218 | 17 | 0.79 | 5369 | 505 | 0.94 | 18594 | 3338 | 1.80 |
| 14 | 1993-94 | 251 | 32 | 1.28 | 7070 | 1251 | 1.77 | 19105 | 3534 | 1.85 |
| 15 | 1994-95 | 334 | 75 | 2.26 | 6449 | 1264 | 1.96 | 16578 | 3882 | 2.34 |
| 16 | 1995-96 | 406 | 101 | 2.49 | 6898 | 1518 | 2.20 | 18828 | 4829 | 2.56 |
| 17 | 1996-97 | 497 | 134 | 2.70 | 7226 | 790 | 1.09 | 17824 | 4420 | 2.48 |
| 18 | 1997-98 | 381 | 104 | 2.69 | 8316 | 163 | 1.88 | 18406 | 3940 | 2.14 |
| 19 | 1998-99 | 555 | 205 | 3.70 | 7643 | 1850 | 2.42 | 18631 | 4435 | 2.33 |
| 20 | 1999-00 | 685 | 155 | 2.26 | 8716 | 1874 | 2.15 | 18906 | 4849 | 2.57 |
| C.G.R. | | +7.3 | +20.06 | +1.74 | +8.53 | +9.74 | +0.2149 | +1.28462 | +5.55 | +0.22 |

Source: Krishi Bhavan U.P., 2001.

Area: in hectare; Production: in metric tonnes; Productivity: in q/ha.

Likewise the area and production in Chitrakoot Dham division under Moong increased to a record level of 8716 hectares and 1874 metric tonnes, respectively during the year 1989-90. Their compound growth rates, were worked out to (+) 8.53 percent and (+) 9.74 percent per annum, respectively during the period 1980-81 1999-2000. The ratio between productivity in 1980-81 while compared with 1999-2000 was of the order of 1:0.90 and it's respective compound growth rate was worked out to (+) 0.2149 percent per annum.

Regarding Moong in Uttar Pradesh, it's area ranged between 11791 hectares during the year 1981-82 to 18906 hectares during the year 1989-90. The annual compound growth rate in area in Uttar Pradesh was worked out to (+) 1.28462 percent. The production increased by 1.28 fold and it's growth rate came to (+) 5.55 percent per annum. Average yield per hectare declined from 2.60q to 2.57q during the period 1980-81 to 1999-2000 with a compared growth rate of (+) 0.22 percent per annum.

**Growth in Area, Production and Productivity of Gram:**

The growth in area production and productivity of Gram in district Chitrakoot Dham region of Uttar Pradesh are given in Table V-4.

Table V-4, shows that the area, production and productivity of Gram in Chitrakoot Dham district did not increase significantly rather they sometimes declined. Their growth rates were calculated at (-) 0.94 percent, (-) 1.33 percent and (-) 0.32 percent, respectively.

**Table V-4: Growth in area, production and productivity of Gram in district Chitrakoot Dham region of Uttar Pradesh during the period 1980-81 to 1999-2000.**

| Sr. No. | Year | Banda district | | | Chitrakoot Dham division | | | Uttar Pradesh | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Area | Production | Productivity | Area | Production | Productivity | Area | Production | Productivity |
| 1 | 1980-81 | 205299 | 114641 | 5.58 | 656014 | 376481 | 5.74 | 2077917 | 1543965 | 7.43 |
| 2 | 1981-82 | 206876 | 161867 | 7.82 | 628907 | 445146 | 7.08 | 1988608 | 1566526 | 7.87 |
| 3 | 1982-83 | 198994 | 151947 | 7.64 | 631275 | 457245 | 7.24 | 1920506 | 1461191 | 7.61 |
| 4 | 1983-84 | 204800 | 89287 | 4.36 | 630922 | 278593 | 4.42 | 1955943 | 1044162 | 5.34 |
| 5 | 1984-85 | 167214 | 65683 | 6.93 | 556690 | 239010 | 4.29 | 1721120 | 1009589 | 5.87 |
| 6 | 1985-86 | 168162 | 96620 | 5.76 | 564413 | 294874 | 5.26 | 1725558 | 1250124 | 7.24 |
| 7 | 1986-87 | 179168 | 101720 | 5.68 | 572954 | 347163 | 6.06 | 1658748 | 1361949 | 8.21 |
| 8 | 1987-88 | 176148 | 90127 | 5.12 | 565640 | 346675 | 6.13 | 1656205 | 1206559 | 7.29 |
| 9 | 1988-89 | 179669 | 128151 | 7.13 | 550202 | 335021 | 6.09 | 1640619 | 1227847 | 7.48 |
| 10 | 1989-90 | 178284 | 29871 | 1.68 | 595453 | 158173 | 2.66 | 1554285 | 692872 | 4.46 |
| 11 | 1990-91 | 168238 | 133406 | 7.93 | 533963 | 378628 | 7.09 | 1495881 | 1288229 | 8.61 |
| 12 | 1991-92 | 166923 | 94335 | 5.66 | 531884 | 402853 | 7.57 | 1571356 | 1061344 | 6.57 |
| 13 | 1992-93 | 180623 | 157624 | 8.73 | 582090 | 482779 | 8.29 | 1515812 | 1394948 | 9.26 |
| 14 | 1993-94 | 163021 | 140417 | 8.61 | 532582 | 407900 | 7.66 | 1383260 | 1186072 | 8.73 |
| 15 | 1994-95 | 164784 | 147360 | 8.94 | 552407 | 435702 | 7.89 | 1393940 | 1272148 | 9.26 |
| 16 | 1995-96 | 161095 | 83222 | 5.17 | 575984 | 389387 | 6.73 | 1501543 | 1300437 | 8.66 |
| 17 | 1996-97 | 167339 | 115966 | 6.93 | 613772 | 452688 | 7.38 | 1492159 | 2133191 | 8.26 |
| 18 | 1997-98 | 173909 | 127996 | 7.36 | 601081 | 431257 | 7.17 | 1391937 | 1056365 | 7.59 |
| 19 | 1998-99 | 159556 | 67027 | 4.20 | 586380 | 382517 | 6.52 | 1324579 | 1167176 | 8.81 |
| 20 | 1999-00 | 211067 | 62275 | 2.95 | 612330 | 383931 | 6.27 | 1304144 | 968979 | 7.43 |
| C.G.R. | | -0.94 | -1.33 | -0.32 | -0.29 | +1.226 | +1.53 | -2.24 | -0.49 | +0.63 |

Source: Krishi Bhavan U.P., 2001.

Area: in ha.; Production: in m.t.; Productivity : q/ha.

As regards the area under gram in Chitrakoot Dham division, it declined from 656014 hectares in 1980-81 to 612330 hectares in 1999-2000 having a compound growth rate of the order of (-) 0.29 percent per annum. The production and productivity increased by 1.02 fold and 1.09 fold, respectively during the aforesaid period.

The total area and total production under Gram in Uttar Pradesh came down in the ratio of 1:0.64. Their respectively growth rates were calculated at (-) 2. 24 percent and (-) 0.49 percent, respectively during the period 1980-81 to 1999-2000. The average yield per hectare of Gram in Uttar Pradesh did not show any increase during the period 1980-81 to 1999-2000. It's annual compound growth rate was worked out to (+) 0.63 percent.

**Growth in Area, Production and Productivity of Pea:**

The growth in area, production and productivity of peas in district Chitrakoot Dham region of Uttar Pradesh during the period 1980-81 to 1999-2000 have been presented in Table V-5.

Table V-5, clearly indicates that the area peas in Chitrakoot Dham district did not increase considerably rather it sometimes declined. It increased from 469 hectares during the year 1980-81 with a negative compound growth rate of (-) 0.86 percent per annum. The production of peas in the district during the year 1980-81 was recorded to the tune of 406 metric tonnes which increased to a record level of 545 metric tonnes during the year 1999-2000 at a growth of (+) 3.15 percent

per annum. Likewise the productivity increased in the ratio of 1:1.16 during the aforesaid period.

**Table V-5: Growth in area, production and productivity of Peas in district Chitrakoot Dham region of Uttar Pradesh during the period 1980-81 to 1999-2000.**

| Sr. No | Year | Banda district | | | Chitrakoot Dham division | | | Uttar Pradesh | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Area | Production | Productivity | Area | Production | Productivity | Area | Production | Productivity |
| 1 | 1980-81 | 469 | 406 | 1.65 | 12816 | 10841 | 8.46 | 724842 | 688536 | 9.50 |
| 2 | 1981-82 | 527 | 501 | 9.50 | 12417 | 12384 | 9.97 | 726767 | 607425 | 8.35 |
| 3 | 1982-83 | 499 | 272 | 5.44 | 10504 | 6406 | 6.10 | 664308 | 411650 | 6.20 |
| 4 | 1983-84 | 399 | 264 | 6.63 | 8396 | 6236 | 7.43 | 608836 | 335000 | 5.50 |
| 5 | 1984-85 | 655 | 566 | 8.64 | 8244 | 6547 | 7.94 | 503967 | 397068 | 7.88 |
| 6 | 1985-86 | 1107 | 1103 | 9.97 | 9944 | 10063 | 10.12 | 502293 | 459780 | 9.15 |
| 7 | 1986-87 | 964 | 732 | 7.59 | 8711 | 6785 | 7.79 | 479481 | 360133 | 7.51 |
| 8 | 1987-88 | 861 | 581 | 6.74 | 6623 | 4189 | 6.32 | 400960 | 287278 | 7.16 |
| 9 | 1988-89 | 629 | 312 | 4.95 | 5130 | 2696 | 5.26 | 378432 | 269957 | 7.13 |
| 10 | 1989-90 | 349 | 139 | 3.98 | 3244 | 1263 | 3.89 | 293365 | 168949 | 5.76 |
| 11 | 1990-91 | 336 | 327 | 9.74 | 3658 | 3572 | 9.76 | 223793 | 212314 | 9.49 |
| 12 | 1991-92 | 530 | 449 | 8.48 | 4891 | 4186 | 8.56 | 246368 | 227229 | 9.22 |
| 13 | 1992-93 | 368 | 412 | 11.19 | 5458 | 6107 | 11.19 | 257732 | 258375 | 10.02 |
| 14 | 1993-94 | 532 | 679 | 12.76 | 6994 | 8885 | 12.70 | 229024 | 268911 | 11.74 |
| 15 | 1994-95 | 405 | 439 | 10.83 | 7845 | 8497 | 10.83 | 242015 | 242045 | 10.00 |
| 16 | 1995-96 | 1010 | 1417 | 14.03 | 9244 | 12969 | 14.03 | 278978 | 330088 | 11.83 |
| 17 | 1996-97 | 468 | 638 | 13.62 | 13644 | 18588 | 13.62 | 276771 | 286336 | 11.05 |
| 18 | 1997-98 | 557 | 700 | 12.57 | 20131 | 25305 | 12.57 | 249495 | 275779 | 11.05 |
| 19 | 1998-99 | 628 | 832 | 13.25 | 42604 | 56450 | 13.25 | 263165 | 321920 | 12.23 |
| 20 | 1999-00 | 544 | 545 | 10.01 | 73805 | 73879 | 10.01 | 307803 | 346587 | 11.26 |
| C.G.R. | | -0.86 | +3.15 | +3.44 | +5.158 | +8.55 | -1.99 | -6.238 | -3.25 | +3.009 |

Source: Krishi Bhavan U.P., 2001.

Area: in ha.; Production: in m.t.; Productivity: q/ha.

The ratio between areas under pass in Chitrakoot Dham division during 1980-81 while compared with 1999-2000 was of the order of 1:5.76. The production ratio was calculated at 1:6.81 and it's respective compound growth rate was worked out to (+) 8.55 percent per annum. Average yield per hectare under peas in the division did not show a considerable increase rather it sometimes declined. It's annual compound growth rate came to (-) 1.99 percent.

The area and production under in Uttar Pradesh declined from 724842 hectares and 688536 metric tonnes during the year 1980-81, respectively to 307803 hectares and 346587 metric tonnes during the year 1999-2000, respectively. Their compound growth rates were worked out to (-) 3.25 percent per annum, respectively. So far as the productivity is concerned, its ratio was worked out to 1:1.18 and its compound growth rate remained at par with the productivity growth rate in Banda district i.e. 3 percent per annum.

**Growth in Area, Production and Productivity of Arhar:**

The growth in area, production and productivity of Arhar in district Chitrakoot Dham region of Uttar Pradesh during the period 1980-81 to 1999-2000 is given in Table V-6.

Table V-6, portrays that area under the Arhar cultivation declined from 31409 hectares during 1980-81 to 29213 hectares during 1999-2000 at an annual compound growth rate of (-)0.332 percent. Likewise the production also did not show any increase in Chitrakoot Dham district. It's annual compound growth rate came to (-) 1.158

percent. The ratio of average yield per hectare in 1980-81 while compared with 1989-90 was calculated at 1:1.08 and its growth rate came to (+) 3.926 percent per annum during the aforesaid period.

**Table V-6: Growth in area, production and productivity of Arhar in district Chitrakoot Dham region of Uttar Pradesh during the period 1980-81 to 1999-2000.**

| Sr. No. | Year | Banda district | | | Chitrakoot Dham division | | | Uttar Pradesh | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Area | Production | Productivity | Area | Production | Productivity | Area | Production | Productivity |
| 1 | 1980-81 | 31409 | 44649 | 14.22 | 93612 | 94102 | 10.05 | 582376 | 678514 | 11.65 |
| 2 | 1981-82 | 22842 | 21019 | 9.20 | 78780 | 75823 | 9.62 | 467761 | 599333 | 12.81 |
| 3 | 1982-83 | 30947 | 49935 | 16.14 | 98238 | 141793 | 14.43 | 564130 | 868647 | 15.40 |
| 4 | 1983-84 | 28599 | 15308 | 5.35 | 98234 | 34288 | 3.49 | 526780 | 309731 | 5.88 |
| 5 | 1984-85 | 32898 | 21265 | 6.46 | 97837 | 61435 | 6.28 | 540365 | 618380 | 11.44 |
| 6 | 1985-86 | 31370 | 38083 | 12.14 | 96350 | 105118 | 10.91 | 528526 | 775099 | 14.67 |
| 7 | 1986-87 | 31247 | 32153 | 10.29 | 97218 | 101787 | 10.47 | 530882 | 751790 | 14.16 |
| 8 | 1987-88 | 32048 | 57815 | 18.04 | 95131 | 115394 | 12.13 | 520720 | 750155 | 14.41 |
| 9 | 1988-89 | 31195 | 48539 | 15.56 | 96507 | 121213 | 12.56 | 501186 | 646457 | 12.90 |
| 10 | 1989-90 | 30750 | 14145 | 4.60 | 98574 | 68903 | 6.99 | 542061 | 538823 | 9.94 |
| 11 | 1990-91 | 29366 | 37177 | 12.66 | 95733 | 116691 | 12.19 | 522567 | 756486 | 14.48 |
| 12 | 1991-92 | 30113 | 41104 | 13.65 | 94057 | 134125 | 14.26 | 515446 | 630164 | 12.23 |
| 13 | 1992-93 | 24718 | 43553 | 17.62 | 77271 | 107561 | 13.92 | 480230 | 561956 | 11.70 |
| 14 | 1993-94 | 30366 | 53320 | 17.56 | 91926 | 142210 | 15.47 | 517538 | 715187 | 13.82 |
| 15 | 1994-95 | 31246 | 57390 | 18.34 | 97349 | 161502 | 16.59 | 520212 | 842025 | 16.19 |
| 16 | 1995-96 | 31059 | 58174 | 18.73 | 89910 | 135584 | 15.08 | 542833 | 738800 | 13.61 |
| 17 | 1996-97 | 27846 | 59907 | 21.51 | 78774 | 141546 | 17.91 | 495694 | 684296 | 13.80 |
| 18 | 1997-98 | 25738 | 53790 | 21.90 | 79483 | 138958 | 17.48 | 513924 | 604657 | 11.77 |
| 19 | 1998-99 | 26277 | 28560 | 10.87 | 71336 | 90316 | 12.73 | 487930 | 661076 | 13.55 |
| 20 | 1999-00 | 29213 | 44696 | 15.30 | 75690 | 110390 | 14.60 | 502041 | 598935 | 11.93 |
| | C.G.R. | -0.332 | -1.158 | +3.926 | -1.07 | +3.023 | +4.124 | -0.166 | +0.4023 | +0.828 |

Source: Krishi Bhavan U.P., 2001.

Area: in ha.; Production : in m.t.; Productivity : q/ha.

So long as the area under Arhar in Chitrakoot Dham division is concerned, its compound growth rate remained at par with the production growth rate in Banda district, i.e. 1.1 percent per annum. The growth in production and productivity in the division shows that they increased considerably to a record level of 110390 metric tonnes and 14.60 q/ha, respectively during the year 1999-2000. Their compound growth rates were worked out to (+) 3,023 and (+) 4.124 percent per annum.

As regards with the annual compound growth rates in area, production and productivity of Arhar crop in Uttar Pradesh during the period 1980-81 to 1999-2000, they were calculated at (-)0.166 percent, (+)0.4023 percent and (+)0.828 percent, respectively.

**Growth in Area, Production and Productivity of Lentil:**

Like other pulse crops, Lentil also has a pride place in human diet in our country. Regarding it's area, production and productivity in district Chitrakoot Dham region of Uttar Pradesh, the annual compound growth rates have been calculated in Table V-7.

Table V-7 indicates that there has been a considerable increase in area of Lentil in Chitrakoot Dham district, Chitrakoot Dham division and Uttar Pradesh during the period 1980-81 to 1999-2000.

**Table V-7: Growth in area, production and productivity of Lentil in district Chitrakoot Dham region of Uttar Pradesh during the period 1980-81 to 1999-2000.**

| Sr. No. | Year | Banda district | | | Chitrakoot Dham division | | | Uttar Pradesh | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Area | Production | Productivity | Area | Production | Productivity | Area | Production | Productivity |
| 1 | 1980-81 | 12063 | 6014 | 5.09 | 55802 | 32399 | 9.05 | 166369 | 100516 | 5.97 |
| 2 | 1981-82 | 11945 | 7716 | 6.46 | 36843 | 28879 | 7.84 | 175510 | 112591 | 6.41 |
| 3 | 1982-83 | 12026 | 11538 | 9.59 | 46220 | 34801 | 7.53 | 188597 | 117549 | 6.23 |
| 4 | 1983-84 | 13100 | 10344 | 7.90 | 51680 | 30839 | 5.97 | 199034 | 93064 | 4.68 |
| 5 | 1984-85 | 18203 | 10708 | 5.88 | 64280 | 38885 | 6.05 | 210825 | 93835 | 4.45 |
| 6 | 1985-86 | 23328 | 14510 | 6.22 | 86919 | 60317 | 6.94 | 230054 | 121725 | 5.29 |
| 7 | 1986-87 | 23038 | 10690 | 4.64 | 83284 | 51199 | 6.15 | 221519 | 108923 | 4.92 |
| 8 | 1987-88 | 20595 | 10056 | 4.88 | 83619 | 52548 | 5.59 | 240259 | 114605 | 4.71 |
| 9 | 1988-89 | 20743 | 14562 | 7.02 | 113840 | 67093 | 5.89 | 300372 | 144788 | 4.82 |
| 10 | 1989-90 | 11443 | 2483 | 2.17 | 82184 | 28930 | 3.52 | 237865 | 84995 | 3.57 |
| 11 | 1990-91 | 12743 | 9188 | 7.21 | 101285 | 70528 | 6.96 | 276399 | 157159 | 5.69 |
| 12 | 1991-92 | 16113 | 11684 | 7.25 | 135066 | 113363 | 8.39 | 338821 | 217039 | 6.41 |
| 13 | 1992-93 | 19716 | 11356 | 5.76 | 158761 | 95716 | 6.03 | 378211 | 205106 | 5.42 |
| 14 | 1993-94 | 17984 | 12948 | 7.20 | 126752 | 108968 | 8.60 | 350238 | 219440 | 6.27 |
| 15 | 1994-95 | 17630 | 11759 | 6.67 | 145773 | 101144 | 6.94 | 384020 | 231859 | 6.04 |
| 16 | 1995-96 | 16686 | 9995 | 5.99 | 147446 | 133563 | 9.06 | 444527 | 315587 | 7.10 |
| 17 | 1996-97 | 19027 | 15374 | 8.08 | 168583 | 150250 | 8.91 | 465956 | 323408 | 6.94 |
| 18 | 1997-98 | 19028 | 14043 | 7.03 | 162905 | 147796 | 9.07 | 435012 | 291094 | 6.69 |
| 19 | 1998-99 | 21403 | 10338 | 4.83 | 175655 | 155589 | 8.86 | 461086 | 352405 | 7.64 |
| 20 | 1999-00 | 25543 | 17906 | 7.01 | 179598 | 155532 | 8.66 | 495273 | 347187 | 7.01 |
| | C.G.R. | +2.268 | +1.89 | +0.614 | +8.75 | +9.08 | +1.37 | +6.16 | +7.29 | +1.68 |

Source: Krishi Bhavan U.P., 2001.

Area: in ha.; Production : in m.t.; Productivity : q/ha.

In district, Chitrakoot Dham division and Uttar Pradesh it increased from 12063 hectares, 55802 hectares and 166369 hectares, respectively in 1980-81 to a record level of 25543 hectares, 179598 hectares and 495273 hectares, respectively in 1989-90 alongwith the annual compound growth rates of (+)2.268 percent, (+)8.75 percent and (+)6.16 percent, respectively. The production of Lentil in Banda district increased from 6014 metric tonnes to 17906 metric tonnes during the period 1980-81 to 1999-2000. It's compound growth rate was worked out to (+) 1.89 percent per annum. Likewise the production under the crop in Chitrakoot Dham division and Uttar Pradesh increased four fold and three fold, respectively during the aforesaid period. Their annual compound growth rates were calculated at (+) 9.08 percent and (+) 7.29 percent, respectively. The compound growth rates of productivity in the district, division and Uttar Pradesh came to (+) 0.614 percent, (+) 1.37 percent and (+) 1.68 percent per annum, respectively.

In view of the above, the study clearly reveals that increased production in pulses during the aforesaid period in the study area was due to the expansion of area under the pulse crops on one hand and marginal increase in productivity on the other. The production growth rate was observed higher than the growth rate of area during the study period. The marginal increase in productivity shows that technology has not helped much to increase the production in the state as well as in the study area. This is to be viewed seriously in the context of various efforts being made to increase productivity through yield increasing technology.

Chapter - VI

# FARM BUSINESS ANALYSIS

This includes the detailed analysis of costs and returns of the individual crop and enterprise as well as on the farms as a whole. For the sake of convenience, the present chapter has broadly been discussed under the following three sub-heads.

**(1)** Economic structure of the sample farms.

**(2)** Economics of production of different crops.

**(3)** Farm economy as a whole.

**(1) Economic Structure of the Sample Farms –**

The present section deals with the economic structure of the sample pulse growers. The structural analysis of the sample farms included the size group-wise distribution of holdings, cultivated area commanded, extent of irrigation, cropping pattern, cropping intensity, investment in fixed capital and level of borrowing made for different purposes.

**Average size of holdings –**

The total number of selected farmers, their cultivated area and its percentage to the respective totals and average size of holdings for the sample farms under different size groups have been shown in table VI-1.

**Table VI-1: Distribution of farms under different size of groups.**

| Sr. No. | Size group (in ha.) | No. of holdings | Percentage to total holdings | Cultivated area (in ha.) | %age to total cultivated area | Average size of holdings |
|---|---|---|---|---|---|---|
| 1 | 0 – 2 | 70 | 70.00 | 72.72 | 32.02 | 1.04 |
| 2 | 2 – 4 | 20 | 20.00 | 79.86 | 35.16 | 3.99 |
| 3 | 4 & above | 10 | 10.00 | 74.55 | 32.82 | 7.45 |
| Total | | 100 | 100.00 | 227.13 | 100.00 | Av. 2.27 |

Table VI-1 shows that the average size of farms came to 2.27 hectares. In case of small size group of farms (0-2 ha.), it accounted for 70.00 percent of the total sample farms but commanded only 32.02 percent of the total cultivated area. As against this situation, the farmers of the largest size group (4 ha. and above) accounted for only 10.00 percent of the total number of holdings but commanded as much as 32.82 percent of the total cultivated area. This indicated the uneven distribution of cultivated land among the farmers of different sizes.

**Number of draft and milch animals –**

The total number of draft and milch animals on the sample farms of different sizes has been given in Table VI-2.

**Table VI-2: Distribution of draft and milch animals on the basis of per farm and per hectare.**

| Sr. No. | Size group (in ha.) | Total number of animals | | Number of animals per farm | | Number of animals per ha. | |
|---|---|---|---|---|---|---|---|
| | | Draft | Milch | Draft | Milch | Draft | Milch |
| 1 | 0 – 2 | 51 | 52 | 0.73 | 0.74 | 0.70 | 0.71 |
| 2 | 2 – 4 | 42 | 39 | 2.1 | 1.95 | 0.54 | 0.49 |
| 3 | 4 and above | 29 | 27 | 2.9 | 2.7 | 0.39 | 0.36 |
| Total | | 122 | 118 | Av.1.22 | Av. 1.18 | Av. 0.54 | Av. 0.52 |

Table VI-2 reveals that per farm average number of draft and milch animals were calculated at 1.22 and 1.18, respectively. On per farm basis the higher number of draft and milch animals were found on larger groups. The per hectare average figures of draft animals was worked out to 0.54. The average number of milch animals came to 0.52 per hectare. It was noted that the per hectare number of draft and milch animals decreased with the increase in the size of farms.

**Irrigated Area –**

The percentage irrigated area to net cultivated area of the sample farms of different sizes is given in table VI-3.

**Table VI-3: Percentage irrigated area of the sample farms.**

| Sr. No. | Size group (in ha.) | Total cultivated area (in ha.) | Total irrigated area (in ha.) | %age to total cultivated area |
|---|---|---|---|---|
| 1 | 0 – 2 | 72.72 | 5.87 | 8.07 |
| 2 | 2 – 4 | 79.86 | 11.19 | 14.01 |
| 3 | 4 & above | 74.55 | 19.26 | 25.84 |
| Total | | 227.13 | 36.32 | Av. 15.99 |

Table VI-3, indicates that the average percentage irrigated area was 15.99 on the sample farms. The higher percentage of irrigated area was observed on larger size group of farms because most of them had their own sources of irrigation which inturn increased the percentage area under irrigation on these farms.

**Investment in fixed capital –**

The investment in fixed capital includes the values of land, farm buildings, draft and milch animals, irrigation structure, implements

and machinery etc. The per farm investment on these items on different size groups of the sample farms have been calculated in Table VI-4.

**Table VI-4: Investment in fixed capital per farm on the sample holding of different sizes.**

[Rs. /Farm]

| Sr. No. | Particular | Size groups (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0 – 2 | 2 – 4 | 4 & above | |
| 1 | Land | 72759.92 (73.84) | 227471.55 (74.98) | 534869.81 (75.01) | 173069.35 (74.70) |
| 2 | Farm building | 8405.22 (8.53) | 27121.84 (8.94) | 64318.46 (9.02) | 20541.45 (8.87) |
| 3 | Live Stocks : | | | | |
| (a) | Draft cattle | 4020.32 (4.08) | 11922.68 (3.93) | 11337.71 (1.59) | 7108.14 (3.07) |
| (b) | Milch cattle | 4384.90 (4.45) | 13075.53 (4.31) | 12621.27 (1.77) | 7804.37 (3.37) |
| | Total live stocks | 8405.22 (8.53) | 24998.21 (8.24) | 23958.98 (3.36) | 14912.51 96.44) |
| 4 | Irrigation | 2355.04 (2.39) | 8767.59 (2.89) | 35225.42 (4.94) | 8227.29 (3.55) |
| 5 | Implements and machinery | 2197.36 (2.23) | 7978.79 (2.63) | 42926.44 (6.02) | 8878.38 (3.83) |
| 6 | Others | 4414.46 (4.48) | 7038.33 (2.32) | 11765.58 (1.65) | 6054.92 (2.61) |
| 7 | Total investment | 98537.26 (100.00) | 303376.31 (100.00) | 713064.69 (100.00) | 231683.91 (100.00) |
| 8 | Investment excluding land | 25777.34 | 75904.76 | 178194.88 | 58614.57 |

Note: Figures in parentheses show the percentages to their respective total.

Table VI-4, clearly indicates that per farm average investment in fixed capital came to Rs. 585477.97 including value of land whereas it was Rs. 168195.37 excluding value of land. The average investment in fixed capital per farm on land came to Rs. 417282.60. The average value of investment on milch and drought animals came to Rs. 14993.03 and Rs. 13593.23, respectively. The total investment excluding land per farm showed an increased trend with the increase in the size of farms.

The increase in investment was mainly because of the higher investment capacity of big farmers. As regards items-wise investment in fixed capital land accounted for the highest share being 71.27 percent to the total investment followed by farm building 8.53 percent, milch animal 2.56 percent, drought animals 2.32 percent, irrigation 3.97 percent, implements and machinery 4.54 percent and others 1.93 percent.

The per hectare investment on different size group of the sample pulse growing farms have been calculated in Table VI-5.

Table VI-5, indicates that on an average, total investment in fixed capital came to Rs. 124598.92 per hectare whereas the respective figure excluding land came to Rs. 33559.00 per hectare. The per hectare investment in fixed capital was noted to be higher on the largest size group of farms. It was because of the higher investment capacity of big farmers.

**Table VI-5: Investment in fixed capital per hectare on the sample holding of different sizes.**

[Rs. / ha.]

| Sr. No. | Particular | Size groups (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0 – 2 | 2 – 4 | 4 & above | |
| 1 | Land | 71360.69 (78.73) | 94067.18 (69.80) | 107691.68 (72.57) | 91039.92 (73.07) |
| 2 | Farm building | 8243.58 (9.09) | 11215.80 (8.32) | 12950.03 (8.73) | 10803.14 (8.67) |
| 3 | Live Stocks : | | | | |
| (a) | Draft cattle | 3943.00 (4.35) | 4930.43 (3.66) | 2282.76 (1.54) | 3718.73 (3.28) |
| (b) | Milch cattle | 4300.57 (4.74) | 5407.17 (4.01) | 2541.19 (1.71) | 4082.98 (3.28) |
| | Total live stocks | 8243.57 (9.09) | 10337.60 (7.67) | 4823.95 (93.25) | 7801.71 (6.26) |
| 4 | Irrigation | 2309.75 (2.54) | 3625.69 (2.69) | 7092.36 (4.78) | 4342.60 (3.49) |
| 5 | Implements and machinery | 2155.09 (12.38) | 3299.50 (2.45) | 8642.82 (5.82) | 4699.14 (3.77) |
| 6 | Others | 4329.61 (4.78) | 12910.59 (2.16) | 2368.91 (1.60) | 3203.04 (2.57) |
| 7 | Total input cost | 95642.49 (100.00) | 134760.36 (100.00) | 148393.92 (100.00) | 124598.92 (100.00) |
| 8 | Investment excluding land | 29281.80 | 40693.18 | 40774.02 | 33559.00 |

**Cropping pattern –**

The pattern of the growing crops on the sample pulse growing farms of different size is given in Table VI-6.

**Table VI-6: Cropping pattern on the sample farm of different sizes.**

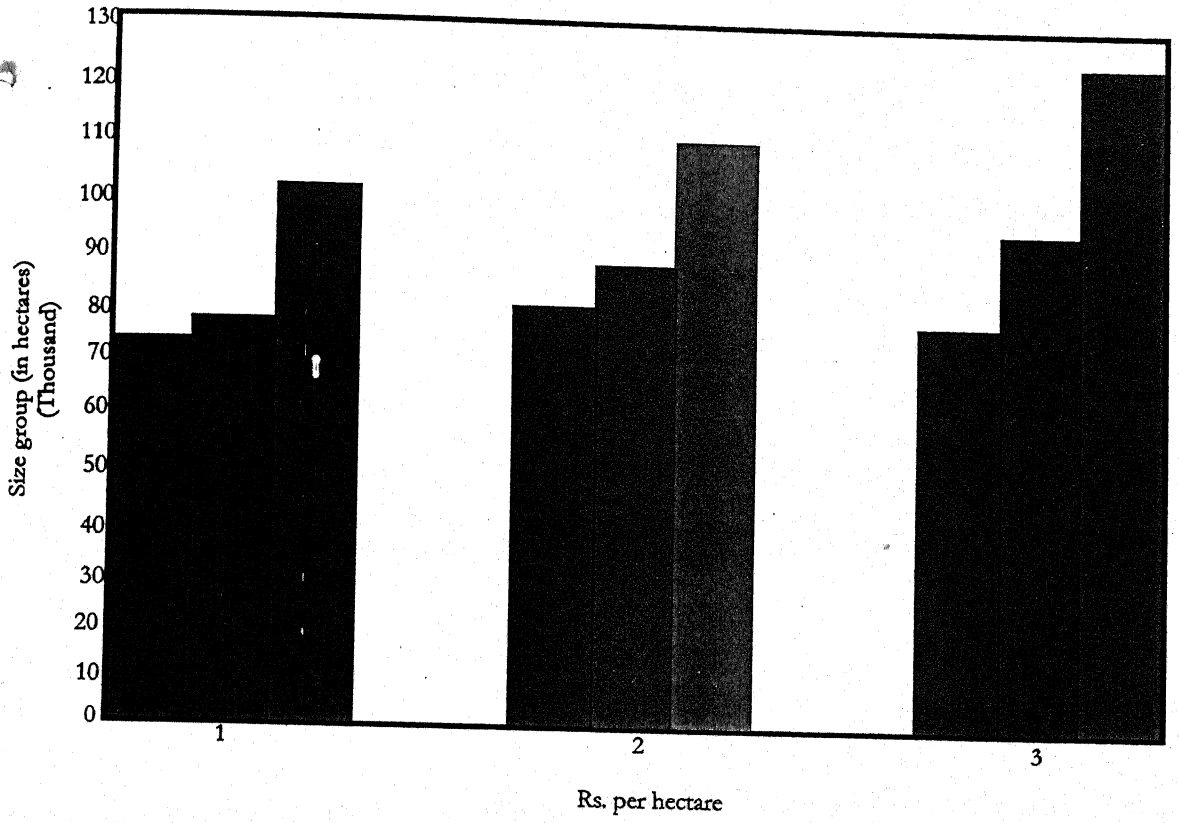
(Area in hectare)

| Sr. No. | Particular | Size group (in ha.) | | | Total |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Gram | 4.23 | 6.30 | 8.09 | 18.62 |
| | | (5.33) | (7.01) | (8.77) | (7.12) |
| 2 | Jowar + | 22.89 | 21.96 | 21.78 | 66.63 |
| | Arhar | (28.87) | (24.43) | (23.62) | (25.49) |
| 3 | Gram | 19.34 | 24.41 | 26.97 | 70.72 |
| | | (24.39) | (27.15) | (29.25) | (27.06) |
| 4 | Lentil | 6.78 | 8.71 | 9.34 | 24.83 |
| | | (8.56) | (9.69) | (10.13) | (9.50) |
| 5 | Lentil | 6.92 | 5.19 | 3.69 | 15.80 |
| | | (8.73) | (5.77) | (4.01) | (6.05) |
| 6 | Wheat + | 15.91 | 19.90 | 21.34 | 57.15 |
| | Gram | (20.07) | (22.14) | (23.16) | (21.87) |
| 7 | Others | 3.21 | 3.42 | 0.98 | 7.61 |
| | | (4.05) | (3.81) | (1.06) | (2.91) |
| | Total | 79.28 | 89.89 | 92.19 | 261.36 |
| | | (100.00) | (100.00) | (100.00) | (100.00) |

Note: Figures in parentheses show the percentage to the respective total.

Table VI-6, indicates that, on an average, gram occupied the highest area being 27.06 percent to the total cropped area followed by Jowar + Arhar 25.49 percent, Wheat + Gram 21.87 percent, Lentil

Fig 2 : **Intensity of cropping on the sample farms of different sizes**



9.50 percent, Paddy 7.12 percent, Lentil 6.05 percent and others 2.91 percent. As regards different size groups, the area under cash and remunerative crops showed an increasing trend with the increase in the size of farms because of the fact that big farmers were putting more area under the cash crops.

**Cropping Intensity:**

Cropping intensity is an important economic indicator to measure the efficiency of a farm. It has been worked out by dividing the total cropped area by net cultivated area and multiplying it by hundred.

The intensity of cropping for the sample farms of different size groups has been worked out in table VI-7.

**Table VI-7: Intensity of cropping on the farms of different size groups.**

| Sr. No. | Size group (in ha.) | Total cultivated area (in ha.) | Total cropped area (in ha.) | Cropping intensity (%) |
|---|---|---|---|---|
| 1 | 0 – 2 | 72.72 | 79.28 | 109.03 |
| 2 | 2 – 4 | 79.86 | 89.89 | 112.56 |
| 3 | 4 and above | 74.55 | 92.19 | 123.67 |
| Total | | 227.13 | 261.36 | 115.07 |

Table VI-7, indicates that the average intensity of cropping was 115.07 percent. It varied from 109.03 percent on "0-2" hectare size group to 123.67 percent on "4 hectare and above" size group. The study area was characterised as a mono and mixed cropping area due to lack of irrigation on one hand and irratic rainfall on the other. Dry farming

practices were generally adopted in the study area which resulted to low intensity of cropping.

## (2) Economics of production of different crops :

The present section deals with the economics of production of important crops grown in the study area. Cost of cultivation is a pre-requisite to estimate the unit cost of production and to judge whether the price of crops is remunerative or not. Economics of production of Crops covers break-up of input cost item-wise, break-up of input cost on the basis of cost concept and level of income obtained from the crops, on the sample farms of different size groups.

## (I) Gram :

Gram is the main crop of district Banda. On an average, gram occupied 27.06 percent of the total cropped area on the sample farms.

### (i) Break-up of cost of input factors of gram :

The break-up of cost of input factors involved in gram crop on the sample farms of different sizes is given in Table VI-8.

Table VI-8, clearly shows that the cost of cultivation per hectare of gram was higher on big farms as compared to small farms. It was due to fact that the big farmers could incur more expenditure on modern farm inputs like quality seed, fertilizers, irrigation, hired labour etc. as a result of borrowing from different credit institutions and better economic status. The higher expenditure resulted into higher yield and returns on these farms as compared to others.

Fig 3 : **Cost and returns on Gram on the sample farms of different sizes.**

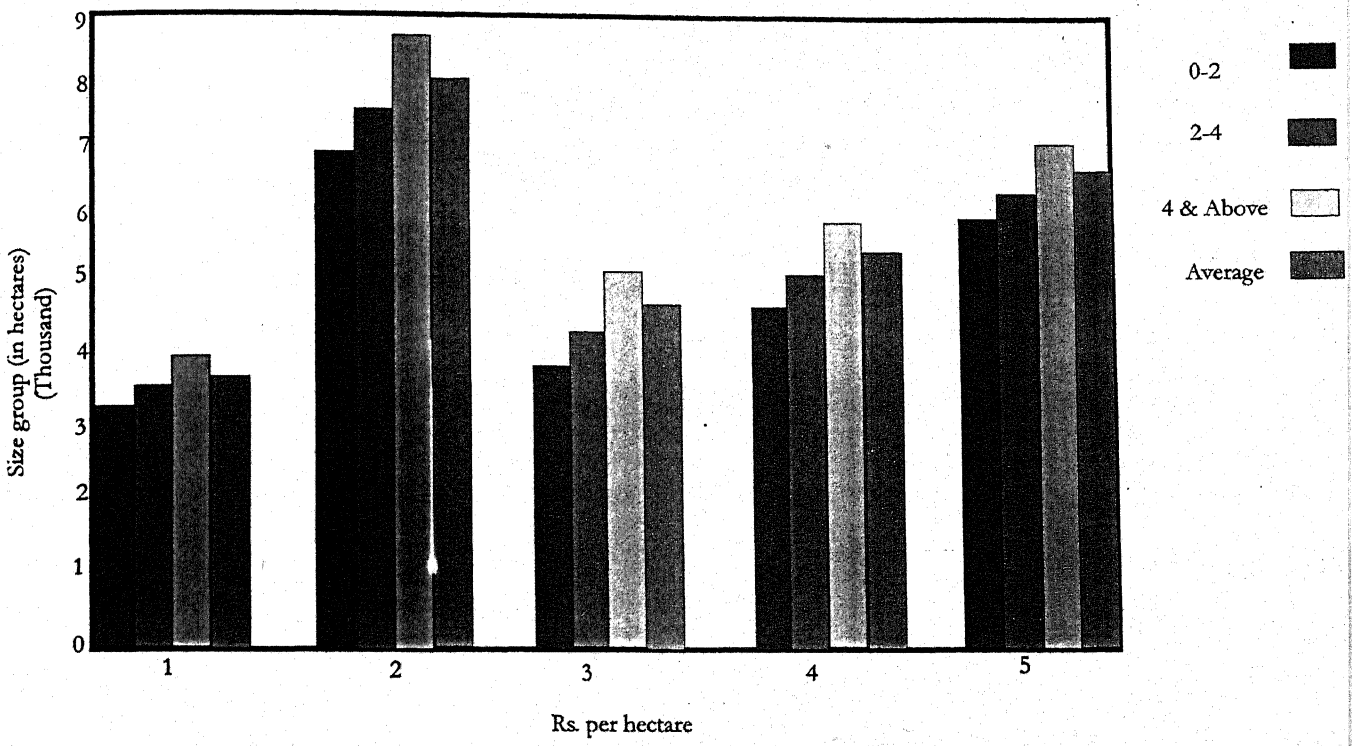


**Table VI-8: Per hectare input cost of gram on the sample farms of different size groups.**

[Rs. /ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Family labour human | 874.32 (19.57) | 830.32 (18.05) | 810.21 (18.13) | 842.34 (18.46) |
| 2 | Hired human labour | 287.58 (6.21) | 426.18 (9.20) | 1280.51 (10.64) | 764.24 (9.05) |
| 3 | Total human labour | 1161.90 (25.78) | 1256.50 (27.25) | 2090.72 (28.77) | 1588.16 (27.51) |
| 4 | Bullock labour | 1520.24 (17.74) | 1690.12 (17.60) | 1732.26 (13.13) | 1711.44 (15.79) |
| 5 | Tractor power | 660.16 (1.98) | 681.22 (2.42) | 732.86 (5.63) | 710.13 (3.64) |
| 6 | Seed cost | 1540.21 (12.23) | 1690.41 (12.47) | 1790.11 (13.52) | 1584.22 (12.84) |
| 7 | Manures & fertilizer | 782.90 (2.58) | 810.14 (2.70) | 932.12 (2.81) | 874.67 (2.71) |
| 8 | Irrigation charges | 736.20 (3.52) | 832.64 (4.04) | 910.42 (4.50) | 836.40 (4.20) |
| 9 | Plant protection | 462.30 (1.53) | 541.21 (1.88) | 640.71 (2.08) | 594.32 (1.87) |
| 10 | Rental value of land | 3000.00 (31.39) | 3000.00 (29.68) | 3000.00 (26.66) | 3000.00 (28.87) |
| 11 | Overhead cost | 1120.40 (2.85) | 1230.16 (1.96) | 1372.41 (2.90) | 1284.76 (2.57) |
| | Total input cost | 10984.32 (100.00) | 11732.41 (100.00) | 13214.61 (100.00) | 12646.37 (100.00) |

Note: Figures in parentheses show the percentage to their respective total.

The average cost of cultivation per hectare of gram came to Rs. 12646.32. The cost of cultivation per hectare showed a rising trend with the rise in the size of farms.

**(ii) Yield and output :**

The yield, value of output per hectare and cost of production per quintal of gram on the sample farms have been worked out in Table VI-9.

**Table VI-9: Per hectare yield, value of output and cost of production per quintal of gram.**

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Input cost | 10984.32 | 11732.41 | 13214.61 | 12646.32 |
| 2 | Production | | | | |
| (a) | Main Product | 12.56 | 13.96 | 15.90 | 14.92 |
| (b) | By-product | 15.10 | 15.66 | 16.90 | 16.30 |
| 3 | Value of product | | | | |
| (a) | Main product @Rs. 510/q. | 13816.00 | 15356.00 | 17490.00 | 16412.00 |
| (b) | By-product @Rs. 20/q. | 755.00 | 783.00 | 845.00 | 815.00 |
| 4 | Total value of production | 14571.00 | 16139.00 | 18335.00 | 17227.00 |
| 5 | Cost production/Qtl. | | | | |
| (a) | Main product | 829.23 | 799.66 | 792.80 | 807.51 |
| (b) | By-product | 37.69 | 36.35 | 36.03 | 36.70 |

Table VI-9, indicates that the average yield per hectare of gram came to 14.92 quintals of main product and 16.30 quintals of by-product on the sample farms.

The cost of production per quintal, on an average was worked out to Rs. 807.51 for main product and Rs. 36.70 for by-product. It decreased with the increase in the size of farms due to higher yields in relation to cost of cultivation on the big farms. The average value of output per hectare came to Rs. 7800.60. The higher value of output on big farms was associated with the higher expenditure incurred on modern farm inputs.

**(iii) Measures of farm profit :**

The value of net income, family labour income and farm business income per hectare on the sample farms of different size groups have been worked out in Table VI-10.

**Table VI-10: Cost and returns on gram on the sample farms of different sizes.**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Input cost | 10984.32 | 11732.41 | 13214.61 | 12646.32 |
| 2 | Output value | 14571.00 | 16139.00 | 18335.00 | 17227.00 |
| 3 | Net income | 3586.68 | 4406.59 | 5120.39 | 4580.68 |
| 4 | Family labour income | 4461.00 | 5236.91 | 6400.90 | 5344.92 |
| 5 | Farm business income | 5581.40 | 6467.07 | 7773.31 | 6629.68 |
| 6 | Input-output ratio | 1:2.23 | 1:2.26 | 1:2.31 | 1:2.24 |

Table VI-10, clearly indicates that, on an average the values of net income, family labour income and farm business income per hectare came to Rs. 4580.68, Rs. 5344.92 and Rs. 6629.69, respectively

on the sample farms of different sizes. The average input – output ratio in gram came to 1:2.25 on the sample farms.

**(iv) Cost – concept :**

The cost and returns on the basis of cost concept in the production of gram have been presented in Table VI-11.

**Table VI-11: Break-up of total input cost, cost concept-wise income over different cost in gram.**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| A | Break-up of the cost | | | | |
| 1 | Cost A | 6269.70 | 6979.47 | 8435.10 | 7840.03 |
| 2 | Cost $A_1$ | 6269.70 | 6979.47 | 8435.10 | 7840.03 |
| 3 | Cost B | 10110.00 | 10902.09 | 12464.40 | 11804.03 |
| 4 | Cost C | 10984.32 | 11732.41 | 13274.61 | 12646.37 |
| B | Income over different costs | | | | |
| 1 | Income over cost A | 7680.33 | 9159.83 | 9959.91 | 6386.59 |
| 2 | Income over cost $A_1$ | 7680.33 | 9159.83 | 9959.91 | 6386.59 |
| 3 | Income over cost B | 4461.00 | 5237.21 | 5930.60 | 5423.02 |
| 4 | Income over cost C | 3586.68 | 4406.59 | 5120.39 | 4580.68 |

Table VI-11, portrays that on an average, cost A, cost B and cost C were worked out to be Rs. 7840.03, Rs. 11804.03 and Rs. 12646.37, respectively on the sample farms. The income over different costs was also worked out. The average income over cost A, cost B and cost C were calculated at Rs. 6386.59, Rs. 5423.02 and Rs. 4580.68 per hectare, respectively.

A size group-wise examination shows that the costs as well as income showed an increasing trend with the increase in the size of farms. It was due to higher investment capacity and higher yield and income of the big farmers.

**(II) Jowar + Arhar :**

On the average, Jowar + Arhar occupied 25.46 percent of the total cropped area on the sample farms.

**(i) Break-up of cost of input factors of Jowar + Arhar :**

Per hectare, break-up of input cost for Jowar + Arhar on the sample farms of different sizes has been given in table VI-12.

Table VI-12, shows that the average cost of cultivation of Jowar + Arhar came to Rs. 11608.38 per hectare. It showed a rising trend with the rise in the size of farms. It was due to the fact that the big farms could incur more expenditure on modern farm inputs.

**Table VI-12: Per hectare cost of Jowar + Arhar on the sample farms of different size groups.**

[Rs./ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Family labour human | 944.62 | 976.90 | 627.24 | 853.57 |
| | | (22.82) | (21.53) | (10.95) | (18.25) |
| 2 | Hired human labour | 192.36 | 290.21 | 856.16 | 469.71 |
| | | (3.10) | (5.51) | (17.06) | (8.77) |
| 3 | Total human labour | 1136.98 | 1267.11 | 1483.40 | 1323.18 |
| | | (25.92) | (18.61) | (28.01) | 927.02) |
| 4 | Bullock labour | 1090.12 | 1167.32 | 972.40 | 1078.19 |
| | | (17.78) | (18.61) | (12.68) | (16.27) |
| 5 | Tractor power | 716.40 | 841.26 | 1079.14 | 881.93 |
| | | (0.92) | (1.51) | (3.07) | (1.87) |
| 6 | Seed cost | 1629.21 | 1751.32 | 1840.64 | 1746.48 |
| | | (8.68) | (8.83) | (9.57) | (9.04) |
| 7 | Manures & fertilizer | 790.32 | 841.21 | 932.36 | 859.26 |
| | | (10.25) | (1.22) | (12.03) | (11.02) |
| 8 | Irrigation charges | 840.32 | 890.21 | 910.27 | 884.26 |
| | | (0.95) | (1.22) | (1.38) | (1.19) |
| 9 | Plant protection | 516.11 | 580.24 | 610.27 | 571.87 |
| | | (0.87) | (1.00) | (1.74) | (1.20) |
| 10 | Rantel value | 3000.00 | 3000.00 | 3000.00 | 3000.00 |
| | | (31.20) | (29.19) | (27.27) | (29.16) |
| 11 | Overhead cost | 1134.36 | 1267.31 | 1381.16 | 1263.21 |
| | | (3.43) | (1.90) | (4.25) | (3.21) |
| | Total input cost | 10097.82 | 11606.17 | 12209.64 | 11608.38 |
| | | (100.00) | (100.00) | (100.00) | (100.00) |

Note: Figures in parentheses show the percentage to their respective total.

**(ii) Yield and output :**

The yield, value of output and cost of production per quintal of Jowar + Arhar on the sample farms are presented in Table VI-13.

Table VI-13, portrays that, on an average, yield per hectare of Jowar and Arhar came to 8.96 quintals and 6.86 quintals, respectively of main product and 33.90 quintals and 11.38 quintals, respectively of by-product on the sample farms. The total value of output, on an average, was worked to Rs. 16511.85 per hectare. The yield and value of output increased with the increase in the size of farms. The cost of production per quintal was worked out to Rs. 330.43 for main product and Rs. 49.21 for by-product in Jowar and Rs. 906.91 for main product and Rs. 66.79 for by-product of Arhar. The cost of production per quintal decreased with the increase in the size of farms.

The cost of production per quintal was higher on the lowest size group of farms because of lower yield as compared to big farmers.

**Table VI-13: Per hectare yield value of output and cost of production per quintal of Jowar + Arhar.**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Input cost | 10097.82 | 11606.17 | 12209.64 | 11608.38 |
| 2 | Production (Qtl.) : | | | | |
| (i) | Main product - | | | | |
| (a) | Jowar | 8.30 | 8.72 | 9.89 | 8.96 |
| (b) | Arhar | 6.34 | 6.83 | 7.43 | 6.86 |
| (ii) | By-product - | | | | |
| (a) | Jowar | 28.00 | 34.33 | 39.67 | 33.90 |
| (b) | Arhar | 9.02 | 11.34 | 13.91 | 11.38 |
| 3 | Value of product : | | | | |
| (i) | Main product - | | | | |
| (a) | Jowar @ Rs.470/q | 3901.00 | 4098.40 | 4648.30 | 4211.20 |
| (b) | Arhar @ Rs.1290/q | 8178.60 | 8810.70 | 9584.70 | 8849.40 |
| (ii) | By-product - | | | | |
| (a) | Jowar @ Rs.70/q | 1960.00 | 2403.10 | 2776.90 | 2373.00 |
| (b) | Arhar @ Rs.95/q | 856.90 | 1077.30 | 1321.45 | 1078.25 |
| 4 | Gross value of output | 14896.50 | 16389.50 | 18331.35 | 16511.85 |
| 5 | Cost of production/q | | | | |
| (i) | Jowar - | | | | |
| (a) | Main product | 318.60 | 332.83 | 313.04 | 330.43 |
| (b) | By-product | 47.45 | 49.57 | 46.62 | 49.21 |
| (ii) | Arhar - | | | | |
| (a) | Main product | 874.45 | 913.51 | 859.21 | 906.91 |
| (b) | By-product | 64.40 | 67.27 | 63.27 | 66.79 |

### (iii) Measures of farm profit :

The values of net income, family labour income and farm business income per hectare on the sample farms of different sizes have been shown in Table VI-14.

It is quite evident from Table VI-14, that on an average Jowar + Arhar gave a net income, family labour income and farm business income of Rs. 4903.47, Rs. 5757.04 and Rs. 9073.04 per hectare, respectively on the sample farms. The average input – output ratio was worked out to 1:1.47. The size group-wise examination revealed that the input – output ratio increased with the increase in farm size.

**Table VI-14: Cost and returns on Jowar + Arhar on the sample farms of different sizes.**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Input cost | 10097.82 | 11606.17 | 12209.64 | 11608.38 |
| 2 | Output value | 14896.50 | 16389.50 | 18331.35 | 16511.85 |
| 3 | Net income | 4798.68 | 4789.33 | 6121.71 | 4903.47 |
| 4 | Family labour income | 5743.30 | 5760.23 | 6748.95 | 5757.04 |
| 5 | Farm business income | 9026.89 | 9077.06 | 10094.24 | 9073.04 |
| 6 | Input – output ratio | 1:1.44 | 1:1.50 | 1:1.40 | 1:1.47 |

**(iv) Cost and returns on the basis of cost concepts :**

The cost and returns on the basis of cost concept of Jowar + Arhar on the sample farms of different sizes have been presented in Table VI-15.

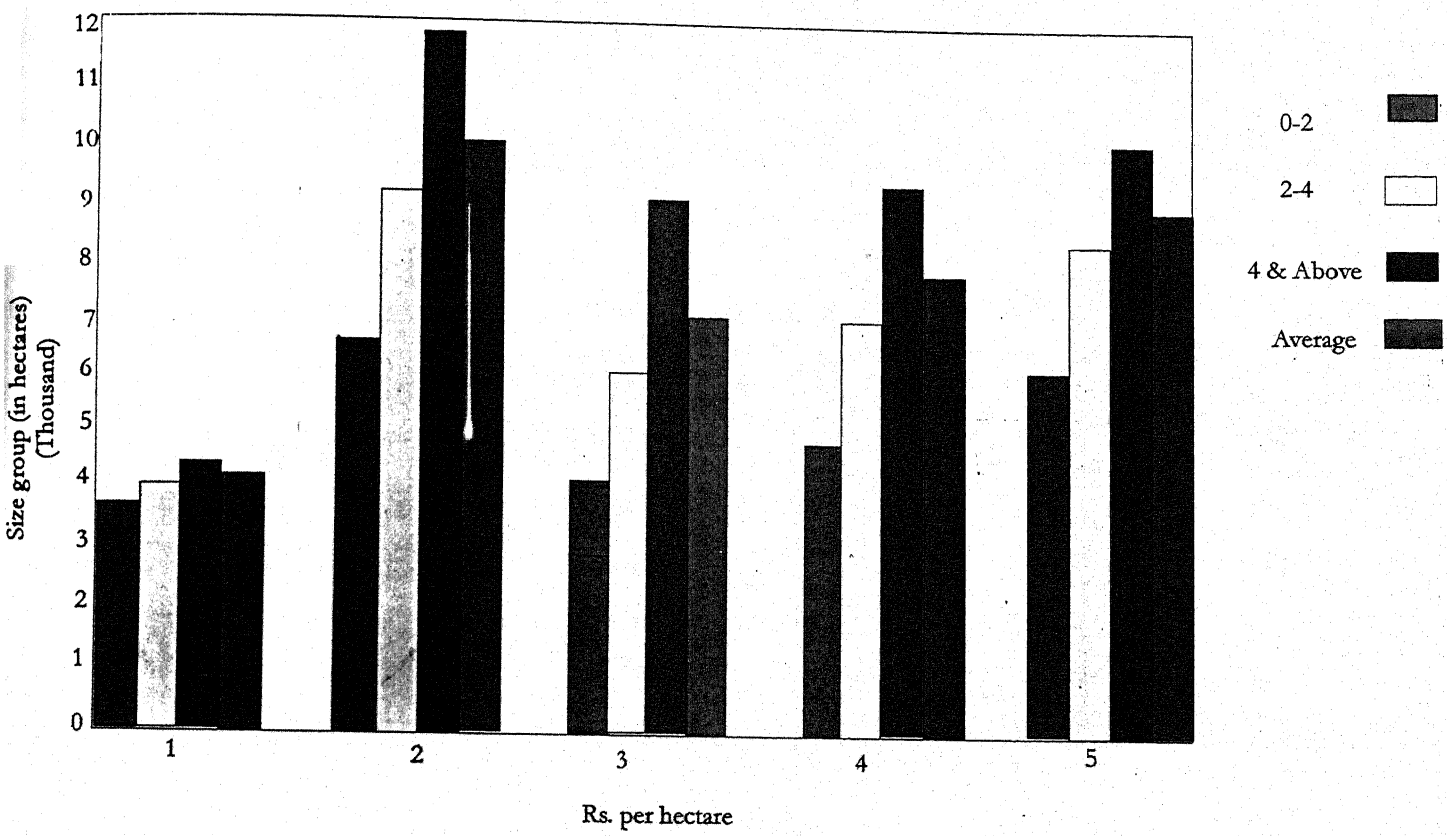
**Table VI-15: Break-up of total cost, cost concept-wise income over different cost in Jowar + Arhar.**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in Rs.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| A | Break-up of cost | | | | |
| 1 | Cost A | 2937.57 | 6896.57 | 7631.92 | 7007.70 |
| 2 | Cost $A_1$ | 2937.57 | 6896.57 | 7631.92 | 7007.70 |
| 3 | Cost B | 9153.20 | 10629.27 | 11582.40 | 10955.11 |
| 4 | Cost C | 10097.82 | 11606.17 | 12209.64 | 11608.38 |
| B | Income over | | | | |
| 1 | Cost A | 9604.11 | 9710.71 | 9748.95 | 9704.45 |
| 2 | Cost $A_1$ | 9604.11 | 9710.71 | 9748.95 | 9704.45 |
| 3 | Cost B | 5753.33 | 5760.23 | 6748.95 | 5757.04 |
| 4 | Cost C | 4798.68 | 4783.33 | 6121.71 | 4903.47 |

Table VI-15, reveals that, on an average Cost A, Cost B and Cost C came to Rs. 7007.70, Rs. 10955.11 and Rs. 11608.38 per hectare, respectively on the sample farms. All these costs increased with the increase in the size of farms. The average income over cost A, cost B and cost C was worked out to Rs. 9704.45, Rs. 5757.04 and Rs. 4903.47 per hectare, respectively on the sample farms. The income per hectare increased with the size group of farms.

Fig 4 : **Cost and returns on Lentil on the sample farms of different sizes.**



## (III) Lentil :

On an average, Lentil occupied 9.50 percent of the total cropped area on the sample farms in the study area.

### (i) Break-up of cost of input factors of Lentil :

The break-up of input factors involved in Lentil crop on the farms of different size group is given in Table VI-16.

Table VI-16, indicates that, on an average, the cost of cultivation per hectare for Lentil to Rs. 8653.27 on the sample farms. The cost of input factors showed a rising trend with the rise in farm size. The rise in cost was associated with the higher expenditure incurred on cash inputs like manures and fertilizers, hired labour, seed etc.

**Table VI-16: Per hectare cost of Lentil on the sample farms of different size groups.**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Family labour human | 877.14 | 912.24 | 892.41 | 897.72 |
| | | (18.96) | (18.13) | (16.48) | (17.71) |
| 2 | Hired human labour | 390.16 | 424.16 | 467.32 | 434.61 |
| | | (5.77) | (7.47) | (10.05) | (8.02) |
| 3 | Total human labour | 1267.30 | 1336.40 | 1359.73 | 1327.33 |
| | | (24.73) | (25.60) | (26.73) | (25.73) |
| 4 | Bullock labour | 1392.74 | 1286.81 | 1206.40 | 1297.31 |
| | | (1392.74) | (18.63) | (16.46) | (18.41) |
| 5 | Tractor power | 241.32 | 376.22 | 404.34 | 343.62 |
| | | (1.96) | (3.16) | (3.45) | (2.95) |

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| | | | | | |
|---|---|---|---|---|---|
| 6 | Seed cost | 840.13 (13.21) | 855.72 (13.95) | 936.11 (14.60) | 879.32 (14.01) |
| 7 | Manures & fertilizer | 296.21 (4.80) | 331.44 (5.19) | 465.22 (5.26) | 367.29 (5.11) |
| 8 | Irrigation charges | 230.76 (1.56) | 253.17 (1.61) | 297.16 91.68) | 263.92 (1.63) |
| 9 | Plant protection | 167.42 (0.94) | 198.86 (1.13) | 240.17 (1.25) | 107.16 (1.13) |
| 10 | Rantel value of land | 3000.00 (28.59) | 3000.00 (27.94) | 3000.00 (27.02) | 3000.00 (27.76) |
| 11 | Overhead cost | 940.13 (3.23) | 927.61 (2.79) | 1021.12 (3.75) | 967.32 (3.27) |
| | Total input cost | 8376.01 (100.00) | 8566.20 (100.00) | 8930.25 (100.00) | 8653.27 (100.00) |

Note: Figures in parentheses show the percentage to their respective total.

**(ii) Yield and output :**

On an average, the yield and value of output per hectare have been presented in Table VI-17. Per hectare yield of Lentil, on an average, came to 8.16 quintals of main product and 10.21 quintal of by-product. The total value of output, on an average, was worked out to Rs. 20145.95 per hectare. The cost of production per quintal was worked out to Rs. 1009.39 for main product and Rs. 40.81 for by-product in Lentil. A size group-wise examination showed that the cost of production per quintal was higher on the smallest size group because of low output in relation to the total input cost.

**Table VI-17: Per hectare yield, value of output and cost of production per quintal of Lentil.**

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Input cost | 8376.01 | 8566.20 | 8930.25 | 8653.27 |
| 2 | Production (Qtl.) | | | | |
| (i) | Main product | | | | |
| | Lentil | 6.25 | 7.90 | 9.80 | 8.16 |
| (ii) | By-product | | | | |
| | Lentil | 7.81 | 9.88 | 12.25 | 10.21 |
| 3 | Value of product | | | | |
| (i) | Main product | | | | |
| | Lentil @ Rs. 2350/q | 14687.50 | 18565.00 | 23030.00 | 19176.00 |
| (ii) | By-product | | | | |
| | Lentil @ Rs. 95/q | 741.95 | 938.60 | 1163.75 | 969.95 |
| 4 | Gross value of output | 15429.45 | 19503.36 | 24193.75 | 20145.95 |
| 5 | Cost of production/q. | | | | |
| | Lentil | | | | |
| (i) | Main product | 1275.72 | 1032.00 | 867.42 | 1009.39 |
| (ii) | By-product | 51.57 | 41.73 | 35.61 | 40.81 |

### (iii) Measures of farm profit :

It is quite evident from Table VI-18, that, on an average, the value of net income, family income and farm business income came to Rs. 11492.68, Rs. 12390.40 and Rs. 15632.23 per hectare from Lentil crop. The input – output ratio was worked out to 1:2.62. It increased with the increase in the size of farms because of higher value of output in relation to total input cost.

**Table VI-18: Cost and returns on Lentil crop on the sample farms of different sizes.**

| Sr. No. | Particular | Size Group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Input cost | 8376.01 | 8566.20 | 8930.25 | 8653.27 |
| 2 | Output value | 15429.45 | 19503.36 | 24193.75 | 20145.95 |
| 3 | Net income | 7053.44 | 10937.16 | 15263.50 | 11492.68 |
| 4 | Family labour income | 7927.58 | 11849.40 | 16155.91 | 12390.40 |
| 5 | Farm business income | 11162.61 | 15081.30 | 19411.19 | 15632.23 |
| 6. | Input – output ratio | 1:1.94 | 1:2.52 | 1:3.21 | 1:2.62 |

**(iv) Cost and returns on the basis of cost concepts :**

The cost and returns on the basis of cost concept of Lentil on the sample farms of different sizes have been presented in Table VI-19. It is evident from table VI-19, that, on an average, Cost A, Cost B and Cost C came to Rs. 3930.06, Rs. 7655.55 and Rs. 8553.27 per hectare, respectively on the sample farms. These costs increased with the increase in the size of farms. The average income per hectare over cost A, cost B and cost C were worked out to Rs. 16115.89, Rs. 12390.40 and Rs. 11492.68 respectively. The income over different costs also increased with the increase in the size of farms because of higher output in relation to total input cost.

**Table VI-19: Break-up of total input cost, cost concept-wise income over different cost in Lentil crops.**

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| A | Break-up of cost | | | | |
| 1 | Cost A | 3793.77 | 3958.25 | 4272.50 | 3930.06 |
| 2 | Cost $A_1$ | 3793.77 | 3958.25 | 4272.50 | 3930.06 |
| 3 | Cost B | 7498.87 | 7653.96 | 8038.34 | 7655.55 |
| 4 | Cost C | 8376.01 | 8566.20 | 8930.25 | 8553.27 |
| B | Income over | | | | |
| 1 | Cost A | 11632.68 | 15545.11 | 19921.75 | 16115.89 |
| 2 | Cost $A_1$ | 11632.68 | 15545.11 | 19921.75 | 16115.89 |
| 3 | Cost B | 7927.58 | 11849.40 | 16155.91 | 12390.40 |
| 4 | Cost C | 7053.44 | 10937.16 | 15263.50 | 11492.68 |

## (IV) Wheat + Gram :

Wheat + gram is the most important staple food crop of the Rabi season in the study area. On an average, wheat + gram occupied 21.87 percent of the total cropped area on the sample farms.

### (i) Break-up of input cost of Wheat + Gram :

The details of input used in the production of wheat + gram on the sample farms have been given in Table VI-20.

Table VI-20, portrays that the average cost of cultivation per hectare of Wheat + gram came to Rs. 10811.32 which showed a rising trend with the rise in farm size. The rise in the cost was associated with the higher expenditure incurred on seed, manure and fertilizers, irrigation, hired labour etc. by the large sized farms.

Fig 5 : **Cost and returns on wheat + Gram on the sample farms of different sizes.**

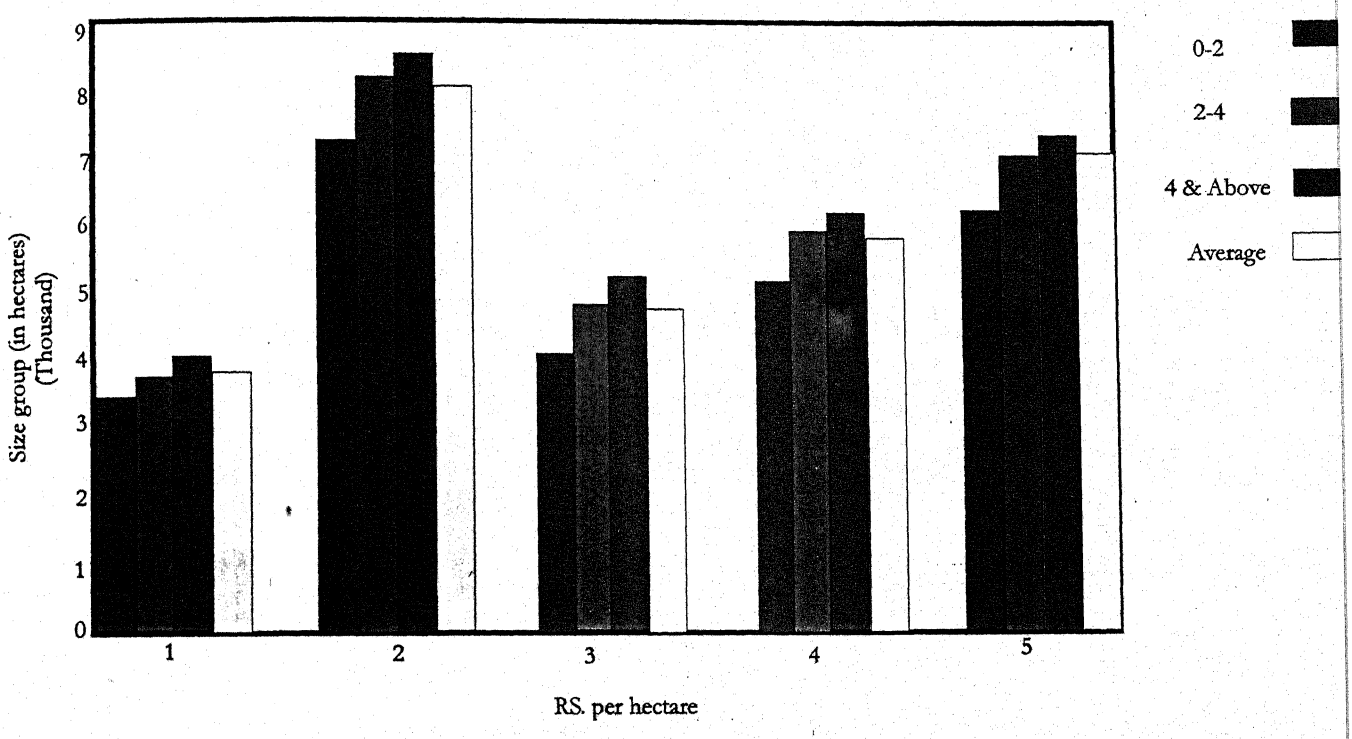


**Table VI-20: Per hectare input cost of Wheat + Gram on the sample farms of different size groups.**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Family labour human | 928.14 (22.30) | 1061.23 (22.62) | 896.84 (18.70) | 967.13 (21.04) |
| 2 | Hired human labour | 324.16 (5.75) | 513.28 (6.89) | 726.19 (11.70) | 527.17 (8.42) |
| 3 | Total human labour | 1252.30 (28.05) | 1574.51 (29.51) | 1623.13 (30.40) | 1494.30 (29.46) |
| 4 | Bullock labour | 1132.40 (19.15) | 1164.31 (18.68) | 1012.62 (13.51) | 1109.18 (16.83) |
| 5 | Tractor power | 262.11 (2.01) | 316.47 (2.44) | 560.90 (4.58) | 384.81 (3.16) |
| 6 | Seed cost | 1100.00 (12.93) | 1240.16 (13.11) | 1361.12 (13.87) | 1239.76 (13.35) |
| 7 | Manures & fertilizer | 1732.11 (3.93) | 1790.41 (1.59) | 1824.36 (4.38) | 1789.29 (4.13) |
| 8 | Irrigation charges | 290.16 (0.96) | 320.41 (1.59) | 570.12 (2.04) | 396.33 (1.25) |
| 9 | Plant pathology | 298.16 (0.87) | 324.36 (0.96) | 464.17 (1.79) | 365.33 (1.25) |
| 10 | Rantel value | 3000.00 (29.25) | 3000.00 (27.90) | 3000.00 (27.38) | 3000.00 (28.06) |
| 11 | Overhead cost | 982.46 (2.85) | 946.14 (1.78) | 1014.15 (2.05) | 983.91 (2.17) |
| Total input cost | | 10049.70 (100.00) | 10676.77 (100.00) | 11430.58 (100.00) | 10811.32 (100.00) |

Note: Figures in parentheses show the percentage to their respective total.

## (ii) Yield and output :

The per hectare yield, value of output from the crop Wheat + gram on the sample farms have been given in Table VI-21.

**Table VI-21: Per hectare yield, value of output and cost of production per quintal of Wheat + Gram.**

[Rs./ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Input cost | 10049.70 | 10676.70 | 11430.58 | 10811.32 |
| 2 | Production (Qtl.) : | | | | |
| (i) | Main product - | | | | |
| (a) | Wheat | 9.01 | 9.96 | 10.39 | 9.86 |
| (b) | Gram | 6.65 | 7.24 | 7.37 | 7.12 |
| (ii) | By-product - | | | | |
| (a) | Wheat | 14.56 | 15.39 | 16.28 | 15.49 |
| (b) | Gram | 7.02 | 8.40 | 9.84 | 8.55 |
| 3 | Value of product : | | | | |
| (i) | Main product - | | | | |
| (a) | Wheat @ Rs.630/q | 5676.30 | 6264.48 | 6545.70 | 6211.80 |
| (b) | Gram @ Rs.1210/q | 8046.50 | 8760.40 | 8917.70 | 8615.20 |
| (ii) | By-product - | | | | |
| (a) | Wheat @ Rs.110/q | 1601.60 | 1692.90 | 1790.80 | 1703.90 |
| (b) | Gram @ Rs.75/q | 526.50 | 630.00 | 738.00 | 641.25 |
| 4 | Gross value of output | 15850.90 | 17347.78 | 17994.20 | 17172.15 |
| 5 | Cost of production/q | | | | |
| (i) | Wheat - | | | | |
| (a) | Main product | 399.43 | 387.73 | 399.85 | 396.64 |
| (b) | By-product | 69.74 | 67.70 | 69.88 | 69.25 |
| (ii) | Gram - | | | | |
| (a) | Main product | 767.16 | 744.70 | 768.64 | 761.80 |
| (b) | By-product | 47.55 | 46.16 | 47.60 | 47.22 |

Table VI-21, shows that the per hectare yield came to 9.86 quintals of main product and 15.49 quintals of by-product from wheat and 7.12 quintals of main product and 8.55 quintals of by-product from gram. The average value of output from wheat + gram was calculated at Rs. 17172.15 per hectare. It varied from Rs. 15850.90 per hectare on the smallest size group to Rs. 17994.20 per hectare on 4 and above hectares size group of farms.

The average cost of production per quintal of wheat was calculated at Rs. 396.64 for main product and Rs. 69.25 by-product whereas the respective figures in gram were calculated at Rs. 761.80 main product and Rs. 47.22 for by-product. It was higher on the small size group because of low value of output in relation to total input cost.

**(iii) Measures of farm profit :**

The value of net income, family labour income and farm business income per hectare of wheat + gram on the sample farms of different sizes have been given in table VI-22.

Table VI-22, shows that, on an average, wheat + gram gave a net income, family labour income and farm business income per hectare of Rs. 6360.83, Rs. 7327.96 and Rs. 10573.94, respectively. The average input – output ratio was worked out to 1:2.21. It increased with the increase in farm sizes because of higher value of output per hectare in relation to total input cost.

**Table VI-22: Cost and returns on wheat + gram on the sample farms of different sizes.**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Input cost | 10049.70 | 10676.70 | 11430.58 | 10811.32 |
| 2 | Output value | 15850.90 | 17347.78 | 17994.20 | 17172.15 |
| 3 | Net income | 5801.20 | 6671.08 | 6561.62 | 6360.83 |
| 4 | Family labour income | 6729.34 | 7732.31 | 7458.46 | 7327.96 |
| 5 | Farm business income | 9974.96 | 10968.85 | 10712.00 | 10573.94 |
| 6 | Input – output ratio | 1:2.13 | 1:2.22 | 1:2.26 | 1:2.21 |

**(iv) Cost concept-wise break-up of costs and income over different costs :**

The costs and returns on the basis of cost-concept in the production of wheat + gram are given in Table VI-23.

Table VI-23, clearly indicates that, on an average, Cost A, Cost B and Cost C came to Rs. 6106.16, Rs. 9844.02 and Rs. 10811.32 per hectare, respectively on the sample farms. The income over different costs was also calculated at Rs. 11065.89, Rs. 7327.96 and Rs. 6360.83 per hectare, respectively on the sample farms. The income over different costs was low in the smallest size groups as compared to the largest size group of arms due to low level of output in relation to total input cost.

Fig 1 : **Cost and returns on wheat on the sample farms of different sizes.**

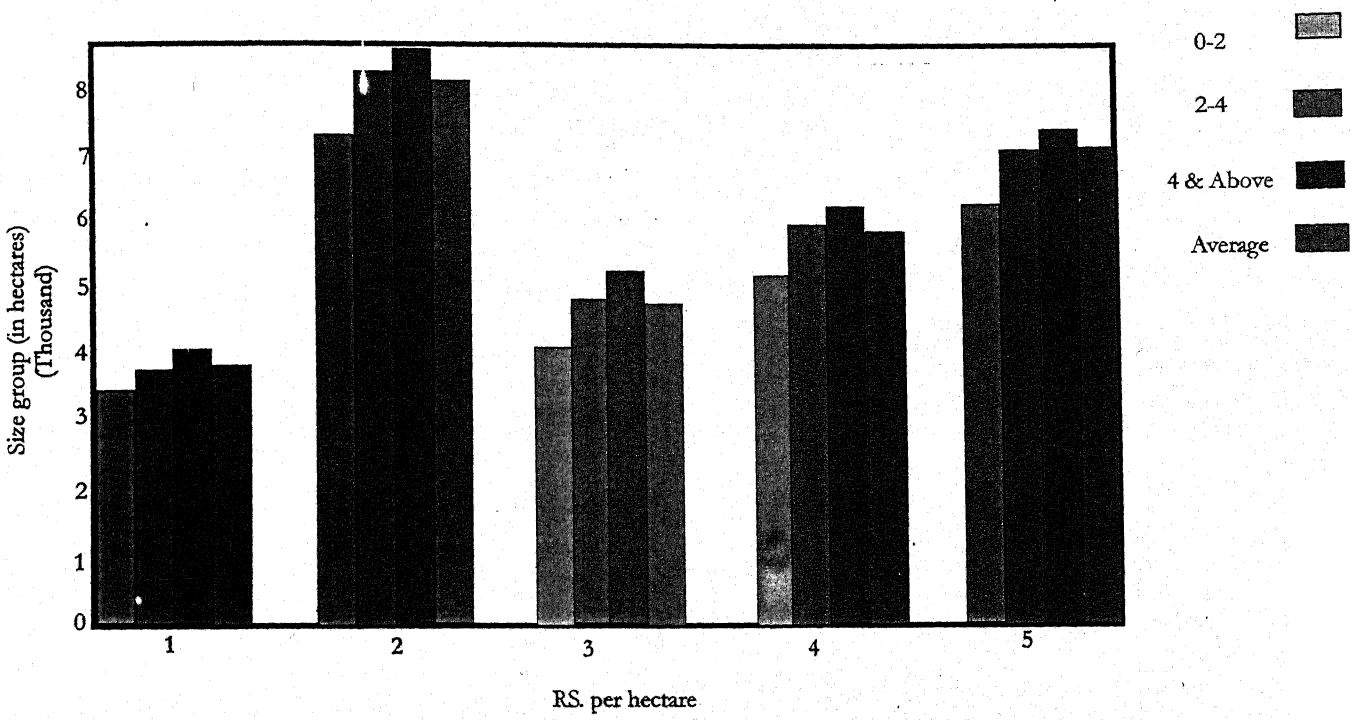


**Table VI-23 : Break-up of total cost, cost concept-wise income over different cost in (wheat + gram).**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| A | Break-up of cost | | | | |
| 1 | Cost A | 5434.71 | 5905.86 | 6775.13 | 6106.16 |
| 2 | Cost $A_1$ | 5434.71 | 5905.86 | 6775.13 | 6106.16 |
| 3 | Cost B | 9121.56 | 9615.47 | 10535.74 | 9844.02 |
| 4 | Cost C | 10049.70 | 10676.70 | 11430.58 | 10811.32 |
| B | Income over | | | | |
| 1 | Cost A | 10466.09 | 11441.92 | 11165.07 | 11065.89 |
| 2 | Cost $A_1$ | 10466.09 | 11441.92 | 11165.07 | 11065.89 |
| 3 | Cost B | 6729.24 | 7732.31 | 7458.46 | 7327.96 |
| 4 | Cost C | 5801.20 | 6671.08 | 6561.62 | 6360.83 |

## (3) Farm Economy as a Whole :

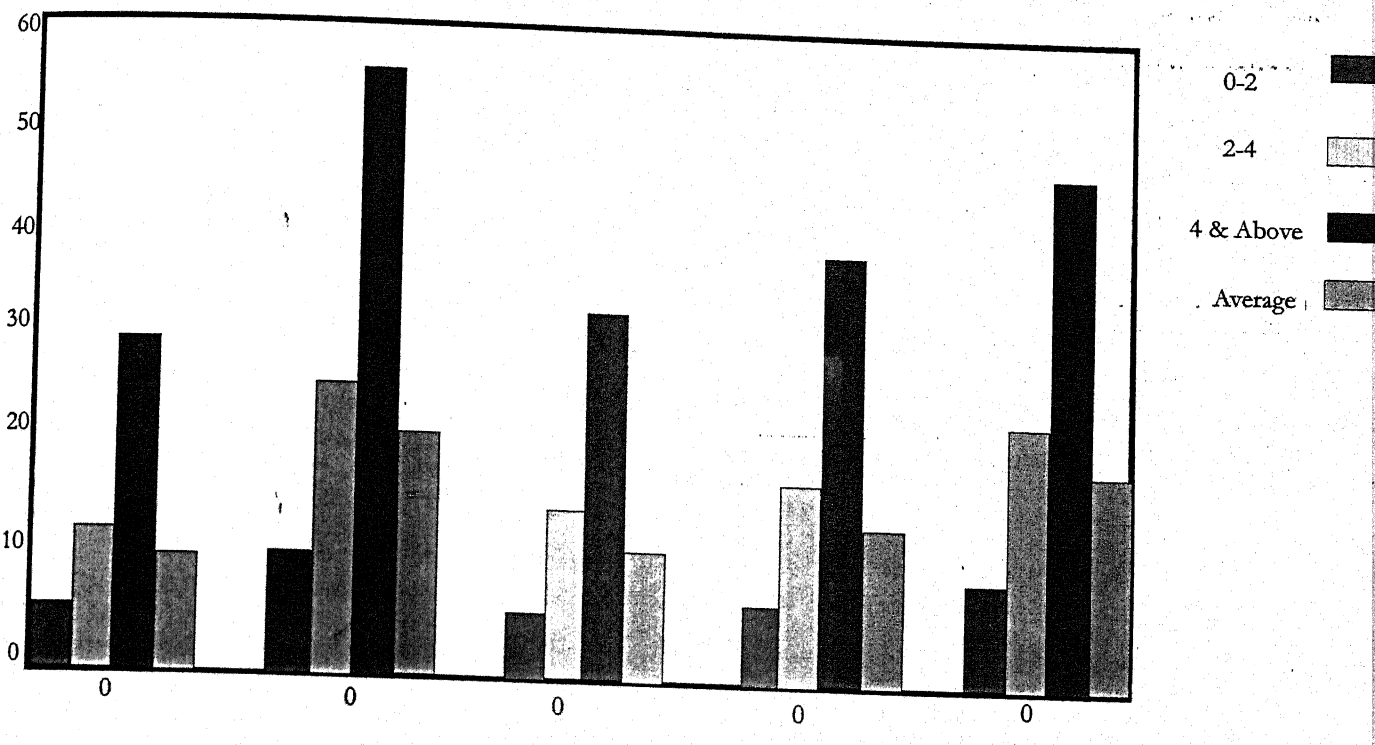
The present section of the investigation deals with the level of income as obtained from the farm business as a whole particularly from crop production.

### (I) Break-up of costs of input factors :

The break-up of cost of input factors in crop production as a whole on the sample farms of different sizes is given in Table VI-24.

Table VI-24, indicates that, on an average, per hectare total input cost on the sample farms came to Rs. 11576.23. It was higher on the largest size group of farms because they could incur higher

Fig 6 : **Cost and returns as whole from different crops on the sample farms of different sizes.**



expenditure because of their better economic status as compared to the small size group of farms.

The break-up of input cost on per farm basis in crop production as a whole on the sample farms is given in Table VI-25.

Table VI-25, shows that, on an average, the total input cost on per farm basis was worked out to Rs. 21046.92. Out of which rental value of land contributed the highest being 28.22 percent followed by human labour 27 percent. The values of human labour were noted higher on larger sized farms in comparison to smaller one. It was because of their higher investment capacity.

**Table VI-24: Per hectare input cost in crop production as a whole on the sample farms of different size groups.**

[Rs. / ha.]

| Sr. No. | Input factors | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Family labour human | 1016.71 (21.01) | 1071.44 (19.95) | 1032.64 (15.70) | 1044.26 (18.61) |
| 2 | Hired human labour | 463.86 (5.19) | 518.41 (7.60) | 841.21 (11.78) | 613.83 (8.54) |
| 3 | Total human labour | 1480.57 (26.10) | 1589.85 (27.55) | 1873.86 (27.48) | 1658.09 (27.15) |
| 4 | Bullock labour | 1147.94 (18.34) | 1314.21 (18.20) | 1274.11 (12.86) | 1251.42 (16.18) |
| 5 | Tractor power | 376.14 (1.68) | 421.12 (2.28) | 690.27 (4.37) | 498.73 (2.92)s |
| 6 | Seed cost | 1230.74 (11.46) | 1427.56 (11.88) | 1871.82 (16.60) | 1514.13 (13.58) |

**Continue....**

| | | | | | |
|---|---|---|---|---|---|
| 7 | Manures & fertilizer | 981.55 (5.24) | 1162.32 (5.19) | 1270.85 (5.33) | 1143.17 (5.26) |
| 8 | Irrigation charges | 420.15 (2.24) | 540.12 (2.55) | 630.24 (2.79) | 533.19 (2.56) |
| 9 | Plant protection | 310.17 (1.15) | 442.76 (1.39) | 502.44 (1.77) | 429.12 (1.47) |
| 10 | Rantel value | 3160.90 (30.63) | 3314.62 (28.97) | 3466.78 (25.82) | 3319.11 (28.22) |
| 11 | Overhead cost | 1014.21 (3.05) | 1210.40 (1.97) | 1271.21 (2.97) | 1169.27 (2.66) |
| | Total Input cost | 10122.78 (100.00) | 11242.96 (100.00) | 12550.58 (100.00) | 11516.23 (100.00) |

Note: Figures in parentheses show the percentage to their respective total.

**Table VI-25: Per farm input cost in crop production as a whole on the sample farms of different size groups.**

[Rs. / ha.]

| Sr. No. | Input factor | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Family labour human | 770.22 | 3095.11 | 5603.28 | 1723.04 |
| 2 | Hired human labour | 190.34 | 1179.38 | 4206.91 | 790.93 |
| 3 | Total human labour | 960.56 | 4274.50 | 9810.19 | 2513.97 |
| 4 | Bullock labour | 672.44 | 2822.50 | 4590.42 | 1498.21 |
| 5 | Tractor power | 61.74 | 353.77 | 1561.30 | 270.46 |
| 6 | Seed cost | 420.29 | 1930.5 | 5925.28 | 1257.81 |
| 7 | Manures & fertilizer | 192.18 | 805.06 | 1902.94 | 486.97 |
| 8 | Irrigation charges | 82.19 | 395.75 | 997.24 | 236.84 |
| 9 | Plant pathology | 42.11 | 214.38 | 632.29 | 135.84 |
| 10 | Rantel value | 1123.13 | 4494.50 | 9219.00 | 2613.6 |
| 11 | Overhead cost | 111.66 | 308.15 | 1061.68 | 246.62 |
| Total Input cost | | 3701.22 | 15500.79 | 35676.48 | 9255.24 |

Note: Figures in parentheses show the percentage to their respectively total.

| | | | | | |
|---|---|---|---|---|---|
| 7 | Manures & fertilizer | 981.55 (5.24) | 1162.32 (5.19) | 1270.85 (5.33) | 1143.17 (5.26) |
| 8 | Irrigation charges | 420.15 (2.24) | 540.12 (2.55) | 630.24 (2.79) | 533.19 (2.56) |
| 9 | Plant protection | 310.17 (1.15) | 442.76 (1.39) | 502.44 (1.77) | 429.12 (1.47) |
| 10 | Rantel value | 3160.90 (30.63) | 3314.62 (28.97) | 3466.78 (25.82) | 3319.11 (28.22) |
| 11 | Overhead cost | 1014.21 (3.05) | 1210.40 (1.97) | 1271.21 (2.97) | 1169.27 (2.66) |
| | Total Input cost | 10122.78 (100.00) | 11242.96 (100.00) | 12550.58 (100.00) | 11516.23 (100.00) |

Note: Figures in parentheses show the percentage to their respective total.

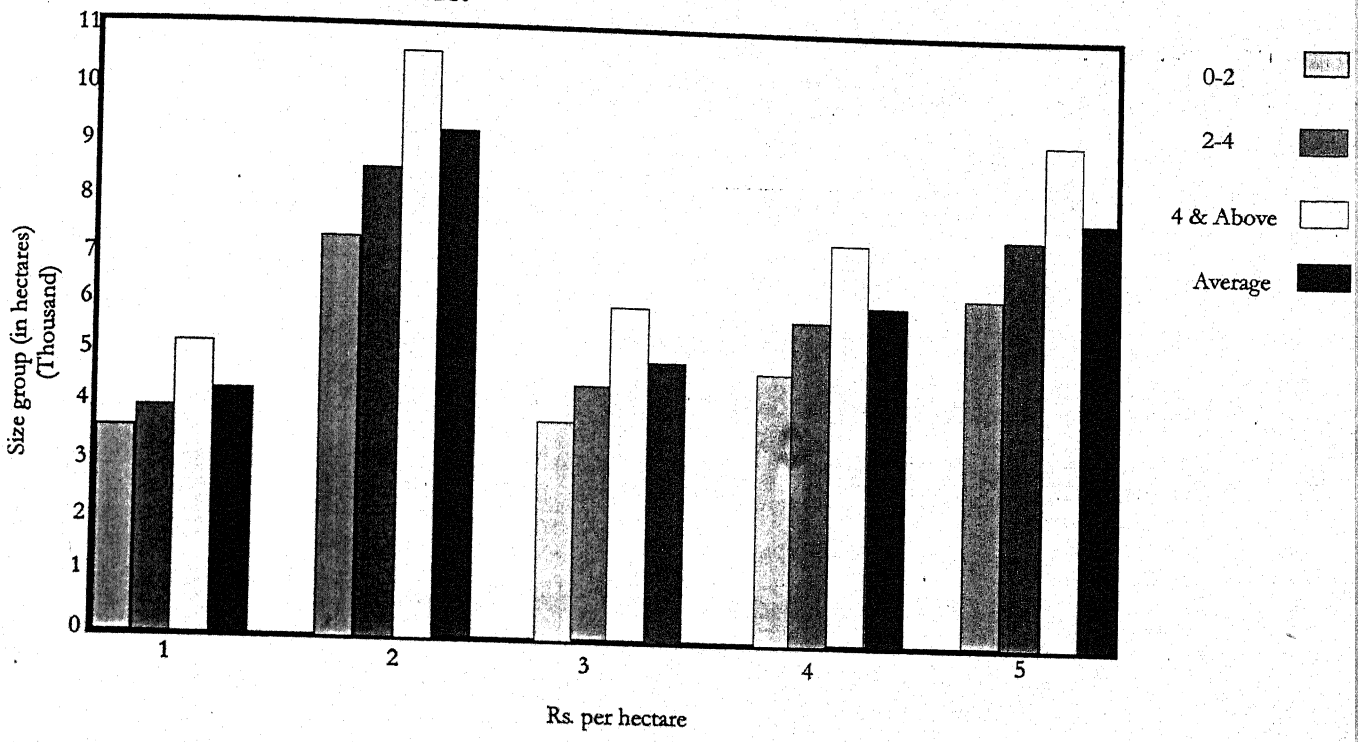
**Table VI-25: Per farm input cost in crop production as a whole on the sample farms of different size groups.**

[Rs. / ha.]

| Sr. No. | Input factor | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Family labour human | 770.22 | 3095.11 | 5603.28 | 1723.04 |
| 2 | Hired human labour | 190.34 | 1179.38 | 4206.91 | 790.93 |
| 3 | Total human labour | 960.56 | 4274.50 | 9810.19 | 2513.97 |
| 4 | Bullock labour | 672.44 | 2822.50 | 4590.42 | 1498.21 |
| 5 | Tractor power | 61.74 | 353.77 | 1561.30 | 270.46 |
| 6 | Seed cost | 420.29 | 1930.5 | 5925.28 | 1257.81 |
| 7 | Manures & fertilizer | 192.18 | 805.06 | 1902.94 | 486.97 |
| 8 | Irrigation charges | 82.19 | 395.75 | 997.24 | 236.84 |
| 9 | Plant pathology | 42.11 | 214.38 | 632.29 | 135.84 |
| 10 | Rantel value | 1123.13 | 4494.50 | 9219.00 | 2613.6 |
| 11 | Overhead cost | 111.66 | 308.15 | 1061.68 | 246.62 |
| Total Input cost | | 3701.22 | 15500.79 | 35676.48 | 9255.24 |

Note: Figures in parentheses show the percentage to their respectively total.

Fig 7 : **Cost and returns as whole from different crops on the sample farms of different sizes.**



## (II) Measures of farm profit :

The measures of farm profits from crop production as a whole on per hectare and per farm basis on the sample farms of different sizes have been worked out in Table VI-26 and VI-27, respectively.

The VI-26 and VI-27, indicates that the average values of net income, family labour income and farm business income on per hectare basis came to Rs. 15311.58, Rs. 16355.84 and Rs. 20551.90, respectively whereas on per farm basis, these values were calculated at Rs. 28243.26, Rs. 33394.99 and Rs. 46095.22, respectively. All these values were higher on large farms. The large farms could invest more on modern farm inputs like – quality seed, manures and fertilizers, irrigation etc. Which in turn resulted into higher yield and income on these farms? The per hectare input – output ratio came to 1:2.17 on the sample farms.

**Table VI-26: Cost and returns as a whole from different crops on the sample farms of different size groups.**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Input cost | 10122.78 | 11242.96 | 12560.58 | 11516.23 |
| 2 | Output value | 22490.14 | 26416.17 | 31560.20 | 26827.81 |
| 3 | Net income | 12367.32 | 15173.21 | 18999.62 | 15311.58 |
| 4 | Family labour income | 13384.03 | 16244.65 | 20032.26 | 16355.84 |
| 5 | Farm business income | 17305.59 | 20467.07 | 24452.45 | 20551.90 |
| 6 | Input – output ratio | 1:2.08 | 1:2.19 | 1:2.21 | 1:2.17 |

**Table VI-27: Cost and returns as a whole from different crops on the sample farms of different size groups.**

[Rs. / ha.]

| Sr. No. | Particular | Size group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| 1 | Input cost | 10247.14 | 27890.17 | 70466.16 | 21046.92 |
| 2 | Output value | 21490.10 | 62190.18 | 115316.16 | 49290.18 |
| 3 | Net income | 11242.90 | 34300.01 | 44850.00 | 28243.26 |
| 4 | Family labour income | 12321.86 | 37214.12 | 50002.73 | 33394.95 |
| 5 | Farm business income | 16649.76 | 46834.98 | 74234.38 | 46095.22 |
| 6 | Input – output ratio | 1:2.08 | 1:2.19 | 1:2.21 | 1:2.17 |

**(III) Cost and returns on the basis of cost-concept :**

The cost and returns on the basis of cost-concept in crop production as a whole on the sample farms of different size groups have been worked out in Table VI-28 and VI-29.

Table VI-28 and VI-29, indicate that, on an average, Cost A, Cost B and Cost C came to Rs. 20551.90, Rs. 21355.84 and Rs. 22410.48 on per farm basis whereas the respective figures where Rs. 6275.91, Rs. 10471.97 and Rs. 11516.23 on per hectare basis. Cost A and Cost $A_1$ were the same on the sample farms due to fact that no case of leased in land was reported during the course of study. A size group-wise examination indicated that all these costs showed an increasing trend with the increase in size of farms. It was due to higher investment capacity of the big farms.

As regards average income over different costs, they gave an increasing trend with the increase in size group of holdings. It was due to higher yield and income on the big farms on per hectare basis as well as on per farm. The per hectare average income over Cost A, Cost B and Cost C were calculated at Rs. 20551.90, Rs. 16355.84 and Rs. 15311.58 respectively. The respective figures on per farm basis were worked out to Rs. 46095.22, Rs. 33394.99 and Rs. 28243.26 respectively on the sample farms of different size groups.

**Table VI-28: Break-up of total input cost, cost concept-wise income over different cost as a whole on the farms of different size groups.**

| Sr. No. | Particular | Size Group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| A | Break-up of cost : | | | | |
| 1 | Cost A | 1639.71 | 1926.30 | 2693.75 | 2086.44 |
| 2 | Cost $A_1$ | 1639.71 | 1926.30 | 2693.75 | 2086.44 |
| 3 | Cost B | 2811.22 | 3109.77 | 4037.18 | 3318.58 |
| 4 | Cost C | 3558.87 | 3884.91 | 4788.79 | 4077.20 |
| B | Income Over : | | | | |
| 1 | Cost A | 5766.15 | 6574.18 | 7871.00 | 6741.12 |
| 2 | Cost $A_1$ | 5766.15 | 6574.18 | 7871.00 | 6741.12 |
| 3 | Cost B | 4594.64 | 5390.71 | 6527.57 | 5508.98 |
| 4 | Cost C | 3846.99 | 4615.57 | 5775.96 | 4750.36 |

**Table VI-29: Break-up of total input cost, cost concept-wise income over different size groups for different crops.**

| Sr. No. | Particular | Size Group (in ha.) | | | Average |
|---|---|---|---|---|---|
| | | 0-2 | 2-4 | 4 & above | |
| A | Break-up of cost : | | | | |
| 1 | Cost A | 4840.24 | 15437.70 | 34769.60 | 13193.93 |
| 2 | Cost $A_1$ | 4840.24 | 15437.70 | 34769.60 | 13193.93 |
| 3 | Cost B | 9168.24 | 24976.06 | 59003.99 | 15894.19 |
| 4 | Cost C | 10247.14 | 27890.17 | 70466.16 | 21046.92 |
| B | Income Over : | | | | |
| 1 | Cost A | 16649.76 | 46834.98 | 74237.12 | 46095.22 |
| 2 | Cost $A_1$ | 16649.76 | 46834.98 | 74237.12 | 46095.22 |
| 3 | Cost B | 12321.86 | 37214.12 | 50002.73 | 33394.95 |
| 4 | Cost C | 11242.96 | 34300.01 | 44850.00 | 28243.26 |

## (4) Production function analysis :

Production function analysis was carried out to determine the efficiency of various resources, used in the process of production on the sample pulse growing farms. Multi-variate analysis of the production function is considered necessary to estimate the contribution of each input to output. It helped in judging the efficiency of resource use under different farm situations. It determined the simultaneous relationship between total farm return and various variable inputs.

The production function equations were fitted using least-square method of regression for which the data were processed with the help of electric – computer DEC – 10, PPN (300104 – 300104) available at the Indian Institute of Technology, Kanpur. With a view to eliminate

the effect of multicollinearity in all those cases where two independent variables were highly correlated, only one of these was retained. Standard errors of regression coefficients were examined and only those variables whose coefficient values were higher than their standard errors were selected for the second and subsequent runs. Though three forms of production function equations, viz., Linear, Quadratic and Cobb-Douglas types were tired, but Cobb-Douglas type of production function was finally fitted as it gave the best fit to the data. Because of higher $R^2$ value obtained in the Cobb-Douglas function, this form was finally retained and other two forms were eliminated from the findings. The Cobb-Douglas production function also provided additional information regarding to scale.

Several production function studies have been reported in Indian agriculture. Rao (1966), Azad and Garg (1974), Acharya and Shukla (1975), Pradash (1975), Sohani and Pawar (1977), Chiswick (1983), Ram Kumar (1985) and Ramesh (1988). All the above workers used Cobb-Douglas production function model due to its relative merits.

**(I) Production function model :**

The functional model adopted is of the following form :

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5}$$

Where,

Y = Output in rupees per hectare.

$X_1$=Expenditure on human labour in rupees per hectare.

$X_2$ = Expenditure on seed in rupees per hectare.

$X_3$= Expenditure on manures and fertilizers in rupees per hectare.

$X_4$= Expenditure on irrigation in rupees per hectare.

$X_5$ = Expenditure on plant protection in rupees per hectare.

a = constant.

$b_1$, $b_2$, $b_3$, --$b_5$ = Regression coefficients of the respective variables.

**(II)** Gram, Jowar + Arhar and Lentil crops were considered for production function analysis on the sample pulse growing farms in the study area. The regression coefficient, adjusted coefficient of multiple determination and returns to scale for the Gram, Jowar + Arhar and Lentil crops on the sample farms are given in Table VI-30.

**(i) Coefficient of multiple determination :**

The coefficient of multiple determinations, on an overall basis, was generally high (Table VI-30) which exceeded from 0.8967 on Jowar + arhar to 0.9199 on Lentil growing farms. It was observed that the variations in the independent variables include in the gross value of output on Jowar + Arhar. Like-wise more than 91.99 percent of the variations in the gross output value on Lentil + Linseed were observed. So far as the Gram is concerned, it's coefficient of multiple

determination was worked out to 0.9198. In the case of gram, 91.98 percent of the variations in the gross output value were observed.

**(ii) Returns to scale :**

Returns to scale imply the behavior of the change of total return of Gram, Jowar + Arhar and Lentil crops, when all the inputs are changed simultaneously in the same proportion. A sum of elastic ties, if equal to one, indicates constant returns to scale.

As regards returns to scale, increasing returns to scale was noticed for all the crops on the sample pulse growing farms.

**(III) Marginal value productivity of resources :**

The production function analysis is generally used to determine the efficiency of resource use, which requires the estimation of marginal value productivity of resources. The knowledge of marginal value productivity of resources is useful as it provides the level at which it is economical for cultivators to use an input. From the policy point of view too, it is important because such analysis depicts the extent to which modern inputs can be used to get the higher level of production.

**Table VI-30 : Regression coefficient, standard error, adjusted coefficient of multiple determination and returns to scale.**

[Rs. / ha.]

| Crop | Intercept in fog | Elasticity of production | | | | | $R^2$ | Returns to scale |
|---|---|---|---|---|---|---|---|---|
| | | Human labour | Seed | Manues and fertilizers | Irrigation | Plant protection | | |
| Gram | 0.8888 | 0.5528* | 0.3019** | 0.0991* | 0.1264* | 0.0512* | 0.9198 | Increasing |
| | | (0.1786) | (0.0291) | (0.0339) | (0.0419) | (0.0169) | | |
| Jowar + Arhar | 0.8765 | 0.5182* (0.1728) | 0.2059* (0.0679) | 0.3109* (0.1028) | 0.0311* (0.0078) | 0.0306* (0.0101) | 0.8967 | Increasing |
| Lentil | 0.12047 | 0.4811* (0.1602) | 0.3142* (0.1046) | 0.1695* (0.0425) | 0.0410* (0.0103) | 0.0271* (0.0089) | 0.9199 | Increasing |

* Significant at 5% level.

** Significant at 1% level.

In the Cobb-Douglas type of production function equation, the marginal value productivity is estimated at geometric mean level. In the present analysis too, the marginal value products of the resources were estimated at their geometric mean levels by taking partial derivatives of returns with respect to the input concerned. It has been worked out as follows :

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5}$$

The partial derivative of the return (Y) with respect to the input.

$X_1 dy / dX_1^{b_1^{-1}} X_2^{b_2} .... X_n^{b_n}$ in the above equation.

The marginal value product of $X_1$ was then obtained by substituting the corresponding geometric mean value of $X_1, X_2 \ldots X_n$ in the above equation.

The marginal value productivity of different input variables in the production of Gram, Jowar + Arhar and Lentil + Linseed crops on the sample pulse growing farms have been worked out in Table VI-31.

**Table VI-31: Marginal value product of various inputs for Gram, Jowar + Arhar and Lentil + Linseed crops on the sample farms (In Rs.).**

[Rs. / ha.]

| Crop | Marginal value productivity | | | | |
|---|---|---|---|---|---|
| | Human labour | Seed | Manures & fertilizers | Irrigation | Plant protection |
| Gram | 4.5351 | 5.3621 | 8.3602 | 6.9426 | 6.2614 |
| Jowar + Arhar | 3.7214 | 4.4543 | 5.5778 | 5.2183 | 5.0819 |
| Lentil | 4.9430 | 5.9508 | 8.9319 | 6.7963 | 6.6158 |

Table VI-31, clearly indicates that the marginal value productivities of manures and fertilizers and irrigation were higher in Gram, Jowar + Arhar and Lentil crops. The $MVP_S$ of fertilizers varied from Rs. 5.5778 on Jowar + Arhar to Rs. 8.9319 on Lentil crops while those of irrigation varied from Rs. 5.2183 on Jowar + Arhar to Rs. 6.9426 on Gram crop under different situations. Like-wise one rupee investment in plant protection resulted into an additional income

varying from Rs. 5.0819 on Jowar + Arhar to Rs. 6.6158 on Lentil crops under different situations.

**(IV) Optimal and existing level of various inputs and returns:**

If the capital is unlimited, maximum profit could be obtained by increasing each capital input to a profit where its marginal value product is equal to its price. But in case where capital is limited, it would be profitable to allocate limited funds, among its various uses in such a way that the marginal returns per unit of money invested on each resource in each use become equal to each other.

The optimal levels of inputs and their existing levels for Gram, Jowar + arhar and Lentil crops on the sample pulse growing farms have been presented in Table VI-32.

Table VI-32, clearly indicates that with the reallocation of sources, the returns can be increased considerably (from 7.65 percent to 11.75 percent under different situations). The resources have to be shifted from human labour to seed, manures and fertilizers, irrigation and plant protection in case of Gram, Jowar + arhar and Lentil crops on the sample pulse growing farms.

The production function analysis clearly suggests that in order of priority, more expenditure on manures and fertilizers, irrigation, plant protection and seed will help in raising the level of production and productivity of Gram, Jowar + Arhar and Lentil crops under situations on the sample farms.

**Table VI-32 : Existing and optimal levels of inputs and returns in crop production as a whole (value in Rs.).**

[Rs. / ha.]

| Sr. No. | Variable | Crop | | |
|---|---|---|---|---|
| | | Gram | Jowar + Arhar | Lentil |
| 1 | Human labour | | | |
| | Existing level | 949.35 | 925.11 | 923.85 |
| | Optimal level | 823.60 | 795.78 | 792.43 |
| | Difference from existing level | (-) 125.75 | (-) 129.33 | (-) 131.42 |
| 2 | Seed | | | |
| | Existing level | 438.56 | 307.86 | 501.11 |
| | Optimal level | 449.85 | 316.13 | 517.47 |
| | Difference from existing level | 11.29 | 8.27 | 16.36 |
| 3 | Manures & fertilizers | | | |
| | Existing level | 92.33 | 371.26 | 180.07 |
| | Optimal level | 147.66 | 477.39 | 279.10 |
| | Difference from existing level | 55.33 | 106.13 | 99.03 |
| 4 | Irrigation | | | |
| | Existing level | 141.82 | 39.71 | 57.26 |
| | Optimal level | 188.35 | 47.77 | 67.53 |
| | Difference from existing level | 47.53 | 8.06 | 10.27 |
| 5 | Plant protection | | | |
| | Existing level | 63.71 | 40.05 | 38.91 |
| | Optimal level | 76.31 | 46.92 | 44.67 |
| | Difference from existing level | 12.60 | 6.87 | 5.76 |
| 6 | Returns (in Rs.) | | | |
| | Existing level | 7788.91 | 6661.35 | 9491.26 |
| | Optimal level | 8483.68 | 7444.06 | 10217.34 |
| | Difference from existing level | 8.93 | 11.75 | 7.65 |

Chapter - VII

# CONSTRAINTS IN PULSE PRODUCTION

# CONSTRAINTS IN PULSE PRODUCTION

Of all the food crops in India, production of pulses has remained stagnant. Depending upon the climate factors, the pulse production has been of fluctuating for more than 3 decades. This has been primarily due to the non-availability of high-yielding, disease-resistant varieties. Another major cause for the low yields is that pulses are grown under deficit moisture with poor management practices. The major causes for low production of pulses in India are ecological factors, lack of appropriate pulse - production and post - harvest technology, basic research and socio-economic constraints alongwith non-availability of quality seed in the required amounts.

**Constraints to production:**

**1- Ecological factors –**

At present about 90% area under pulse cultivation in the study area is rain fed. Furthermore than 50 percent of the area under pulses is planted in the post-rainy (Rabi) season, largely on limited soil moisture. It was presumed that with increasing irrigation potential in the area more and more area under pulse cultivation will be brought under irrigation. There has not been any increase in irrigated area under pulse cultivation which continues to remain around 11.67 percent.

Management of soil moisture is crucial in the case of rain fed technology. This involves various operations, like-grading, land shaping drainage, erosion control methods, individual field contours etc. Such measures involve community and group action, but effective field-extension services to motivate such an action are inadequate.

High temperature and moisture stress greatly increase flower drop and bud abortion. These cause considerable reduction in yield in major pulses. Frost and low temperature during the night cause heavy damages to Rabi pulses particularly to chickpea, whereas continuous rain invites more insect pests and diseases both in kharif and Rabi.

Because of their capacity to withstand adverse soil moisture conditions, pulse crops have become the crops of the poor resource base cultivators having large unirrigated lands in the study area.

**2- Non-availability of high yielding varieties –**

Since ages pulse crops have been cultivated under rain fed conditions in marginal lands with low-input management in the study area. As a result, they have evolved in such a way that even under extreme unfavorable situations they produce small quantities of seeds. In the process, genotypes of different pulses have got themselves adopted for the purpose of survival, fixing their genetic at lower yield levels.

Pulse crops in general have poor harvest index (HI). Improvement in the HI in cereal crops in the recent years has resulted in very high yields. In pulses the HI ranges from 10 to 20 as compare to 40

and above in wheat. Mixed cropping of pluses with other crops is an improvement agronomic practice in Chitrakoot Dham area of the state. Here we could have two situations: (i) The pulse crop completes its life-cycle before the second crop enters the active growth phase or (ii) The pulse crop enters the active growth only after the subsidiary crop has completed its life-cycle. Although, a number of improved varieties of different pulse crops have been recommended, yet they have not become popular among the farmers in the study area mainly due to lack of a systematic seed multiplication and distribution Programme.

**3- Lack of proper agronomic management –**

Because pulses as a group can utilize the limited soil moisture and nutrients better than cereal crops, they are grown in areas which are left out after satisfying the demands of cereals and other cash crops. However, pulse crops also do respond to soil moisture and other inputs and hence the need for appropriate practices in the study area.

**4- Poor management conditions -**

The concept that pulses can grow and produce better yields on marginal lands without any inputs and management is not correct. Being protein-rich crops, pulses require more energy input per unit of production as compared to cereals. But on the contrary they are grown under conditions of energy starvation in poor yields in the study area.

**5- Non-availability of efficient rhizobium culture –**

In general, rhizobium culture is the cheapest input with high cost benefit ration. Symbiotic nitrogen fixation takes place very effectively if the natural relationship is established between the legume cultivar and its specific strain of rhizobium. However, use of rhizobium culture is not getting popular among the farmers of Chitrakoot Dham because unlike fertilizers, the specific culture of desires quality is not readly available in the market.

Many times spurious cultures are supplied to the farmers which are not effective and the farmers lose faith in using rhizobium culture.

**6- Improper sowing time –**

The time of sowing makes a big difference in the production of pulses. The pulses are generally sown after the completion of planting of other crops and thus, they get the last preference and priority in sowing schedules. The late sowing not schedules. The late sowing not only results in poor growth but also makes them prone to high incidence of insect pests, diseases and to adverse temperatures at the ripening stage. All these factors individually reduce the yields drastically.

**7- Inadequate seed rate –**

Adequate plant population makes a big difference in yield. Farmers in the study area generally do not follow the recommended

seed rate. For example, the farmers have been using 10 to 15 kg seed/ha as against the required rate of 20 to 25 kg seed/ha in green gram, black gram and pigeon pea. As such the plant population on the farmers' fields is very sparce, and this is one of the major causes of low yields.

**8- Defective method of sowing –**

Generally pulses are sown by broadcasting method in the study area. This practice results in uneven distribution of seeds that creates a lot of problems in adopting essential agronomic practices such as weeding, interculturing, spraying and harvesting. Also, a large proportion of the seeds are eaten away by birds and a portion of the seeds fail to germinate because of the lack of adequate moisture at the soil surface.

**9- Weed infestation –**

Because of their inherent slow growth at the initial stage, pulse crops suffer due to infestation of weeds. Depending upon the duration of the crop, the critical period for weed competition in the pulses varies from 20 to 45 days after sowing. If weeds are not controlled during this period, marked crop losses ranging from 30 to 50 percent in chickpea, 50 to 70 percent in green gram and black gram and as high as 90 percent in pigeon pea have been recorded in Chitrakoot Dham division of U.P.

## 10- Losses due to diseases and insect pests –

Pulses in general are susceptible to a large number of diseases and insect pests which cause heavy losses. Though three are several diseases which attack pulse crops, the major diseases are wilt, blight and grey-mould in chickpea, wilt, stem blight and sterility-mosaic in pigeon pea, yellow-mosaic, powdery-mildew and leaf spot disease in green gram, black gram and cowpeas. For yield stability and wider adaptability of genotypes, it is essential that varieties with multiple resistances to these major diseases are identified, adopted and popularized. Such multiple-resistant varieties are wanting among the pulse crops.

## 11- Basic research factors –

An intensive multidisciplinary approach for the improvement of pulse crops in India started in 1965 with the initiation of the All India Pulse Improvement Project by the ICAR, in collaboration with its various institutes and state agricultural universities. However, emphasis was only on the production aspect, consisting of disciplines of breeding, agronomy, pathology and entomology. Basic research was completely missing, and unfortunately a similar situation continues till today. Although 20 years of intensive research programme has led to the development of innumerable better yielding varieties, yet their impact on pulse production has only been marginal.

However, the major constraint to pulse production in the study area as well as in the country is the lack of genotypes with higher-

yield potential on farmers' fields. Cultivates in hand exhibit lower productivity, non-synchronous flowering/fruiting, non-responsiveness to good management, non-suitability to various cropping systems, complete or partial absence of genetic resistance to major diseases and pests.

**12- Socio-economic factors –**

The socio-economic constraints of pulses largely emerge from the interaction of agro-climatic factors, farming systems and the characteristics of the pulse crops themselves. Pulses not only constitute an important component of the food chain of the self-providing farmers in the study area alike other parts of the country but they also offer important and low cost options for the purpose of fertility management, risk diffusion and utilization of deficient land resources because of their ability to withstand soil moisture stress conditions which other crops are not able to. However, despite their important function, pulses have only subsidiary status as catch crops or mixed crops around major food and commercial crops in the total farming systems with the farmers. The subsidiary status of pulses in traditional farming systems is reflected through the pattern of limited allocation of resources to these crops.

Yet another major socio-economic factor which prevents farmers from taking up pulse cultivation is because the majority of the farmers are at the poverty level, and own very small holdings. The first priority of the small and marginal farmers is to grow enough cereals for his own consumption so as to keep himself away from market

borrowings and purchases. He can live without pulses but not without cereals.

**Suggestions:**

**Strategy for increasing pulse production –**

Pulse crops with very wide agro climatic adoption exhibit largest variation in form, genotype, yield and response to extrinsic environmental factors, while some of the varieties withstand well under low temperature, some thrive well in tropics. Similarly, the varieties also differ in their requirement for fertilizer. Keeping the above facts in view, the strategy for increasing the pulse production in the study area may be as follows :

(i) Development of high yielding varieties with early maturity which may be grown under better management condition as pure crop.

(ii) Improvement in the plant type specially suited to the inter cropping /mixed cropping.

(iii) Evaluation of varieties which may give better and stable yields under rainfed/restrained irrigation condition.

(iv) Development of high yielding varieties for salt, sick soils.

(v) Standardization of effective and economic plant protection schedules and organization of plant protection measures on mass scale to control the insect, pests and diseases.

(vi) Development of disease resistant varieties.

(vii) Strengthening of the input resource mobilization programme especially for the production and distribution of good quality seed.

(viii) Encouraging moong and urd cultivation in summer season after harvest the wheat and mustard crops.

(ix) Intensive pulses area should be located and efforts should be made to make available all the inputs on the pattern of intensive area district programme.

(x) To convince the farmers of the benefit of adoption of improved technology available large scale demonstration should be undertaken in all the important pulse crops growing areas especially in command ones. In drier tracts, farmers may be given education for one or two protective irrigation at critical stages of plant growth.

(xi) Adequate training programme of the field workers at all the levels may be conducted so as to transfer the existing production technology.

Chapter - VIII

# DISCUSSION

# DISCUSSION

The present chapter attempts to discuss the issues developed on the basis of findings of the study in relation to **"Production and productivity performance of pulses and their contribution in income and employment on farms in Chitrakoot Dham region of U.P. state"** Of the total agricultural crops grown in India, pulses are the most important because they are the major source of protein to the majority of the people in the country who live on vegetarian diet. Pulses not only have nutritional value for human beings but also contribute to soil fertility besides providing nutritious green fodder and feed to live-stock. Pulses provide the most important food ingredient of protein in diet and are 2-3 times richer in protein than most of cereals. In U.P. there has been no growth or negative growth in pulse production during the last 20 years. However, in Chitrakoot Dham there was positive growth in pulse production during this period. Due to inadequate irrigation facilities the pulses could be grown well in Chitrakoot Dham and provided better returns as compared to input cost.

On the basis of findings in previous chapter following issues may be raised for discussion:

(i) What is the rate of growth in area, production and productivity of pulses in the State, Chitrakoot Dham division?

(i) What is the rate of growth in area, production and productivity of pulses in the State, Chitrakoot Dham division?

(ii) Whether the productivity of pulse crops per unit of area on the sample farm is below or above the average productivity of pulses of the state?

(iii) Whether the pulses have contributed major part of the farm income?

(iv) What is the employment potential of the pulse crops?

(v) Is there any difference in the rational use of resources and level of returns amongst different size-group of farms in pulse cultivation?

(vi) What are the constraints in pulse production in the study area?

(vii) How these constraints may be removed?

Regarding the area, production and productivity of pulses in Uttar Pradesh, much increase could not be observed so far. The overall area under pulses has shown a decreasing trend at the rate of (-) 1.01 percent per annum in the state with effect from 1970-71 to 1989-90. As regards the production, it declined from 3069.26 thousands tonnes to 2412.73 thousands tonnes during the period 1970-71 to 1989-90. It's compound growth rate was worked out to (-) 0.11 percent per annum. Likewise average yield declined from 8.24 quintals per hectare to 8.08 quintals per hectare during the period mentioned as above. The compound growth rate average yield was worked out to (+) 1.47 percent per annum. So far as the area, production and productivity of pulses in

Chitrakoot Dham district are concerned they showed a marginal positive increase. The area and production under Urd, Moong, Gram, Peas, Arhar and Lentil pulse crops in Chitrakoot Dham division increased from 13139 hectares and 51512 m.t., 2098 hectares and 495 m.t., 656014 hectare and 376481m.t., 12816 hectares and 10841 m.t., 93612 hectares and 94102 m.t. and 55802 hectares and 32399 m.t. respectively during the year 1970-71 to 54202 hectares and 62265 m.t., 8716 hectares and 1874 m.t., 612330 hectares and 383931 m.t., 73805 hectares and 73879 m.t., 75609 hectares and 110390 m.t. and 179598 hectares and 155532 m.t., respectively during the year 1989-90. Likewise the productivity under the respective crops in the Jhansi division varied from 4.24, 2.36, 5.74, 8.46, 10.05 and 9.05 quintals per hectare, respectively during the year 1970-71 to 2.69, 2.15, 6.27, 10.01, 14.60 and 8.66 quintals per hectare, respectively during the year 1989-90 alongwith their growth rates of (+) 1.47, (+) 0.21, (+)1.53, (-) 1.99, (+) 1.37 percent per annum, respectively. The rates of growth in area, production and productivity in Chitrakoot Dham district were calculated at (+) 5.25, (+) 2.71 and (+) 1.72 percent respectively in Urd pulse crop during the period 1970-71 to 1989-90 followed by (+) 7.30, (+) 20.06 and (+) 1.74 percent in Moong, (-) 0.94, (-) 1.33 and (-) 0.32 percent in Gram, (-) 0.86, (+) 3.15 and (+) 3.44 percent in Pea, (-) 0.33, (-) 1.15 and (+) 3.92 percent in Arhar and (+) 2.26, (+) 1.89 and (+) 0.61 percent in Lentil pulse crops. The study clearly reveals that increased production of pulses during the aforesaid period was due to the expansion of area under the pulse crops on one hand and marginal increase in productivity on the other hand. The

production growth rates were observed higher than the growth rates of area during the study period. The average productivity of pulses of the state during the year 2001-02 came to 8.57 quintals per hectare while that of Chitrakoot Dham district it came to 8.95 quintals per hectare for the same period which was higher than that of state's productivity. The marginal increase in productivity shows that technology has not helped much to increase the production in the country as well as in the study area. This is to be viewed seriously in the context of various efforts being made to increase productivity through yield increasing technology.

Regarding the level of resources used and the level of returns received on farms as a whole of different sizes, it may be mentioned that higher use of inputs have resulted in higher yields and greater profits to the pulse growers. On an average, the yield per hectare of gram came to 14.65 quintals followed by 6.86 quintals of Arhar and 8.16 quintals of Lentil on the sample farms of different sizes during the year 1990-91 whereas the average yield per hectare in the state of Uttar Pradesh for the same period was 7.43 quintals for Gram, 11.93 quintals for Arhar and 7.08 quintals for Lentil which were lower, except arhar, than that of the sample farms in the study area. On an average, the total input cost on per farm basis was worked out to Rs. 7716.96. Out of which rental value of land contributed the highest being 28.22 percent followed by human labour 27 percent. The values of human labour were noted higher on large sized farms in comparison to small one because of their higher investment capacity. Likewise the value of output was higher on large sized farms being Rs. 10564.75 per hectare. The average

values of net income, family labour income and farm business income on per hectare basis came to Rs. 4750.36, Rs. 5508.98 and Rs. 6686.84, respectively, whereas on per farm basis, these values were calculated at Rs. 10703.34, Rs. 12506.38 and Rs. 15304.95, respectively. All these values were higher on large farms. The large sized farms could invest more on modern farm inputs like-quality seed, manures and fertilizers, irrigation etc. which intern resulted into higher yield and income on these farms. The average values of cost A, cost B and cost C were worked out to Rs. 4738.79, Rs. 7537.24 and Rs. 9255.24 per farm, respectively. As regards the income over cost A, cost B and cost C, they came to Rs. 15311.29, Rs. 12512.72 and Rs. 10789.68 per farm, respectively on the sample farms of different sizes. A size group-wise examination in size of farms due to higher yield and output value in relation to total input cost on the big farms.

Several production function studies have been reported in Indian agriculture. Rao (1966), Azad and Garg (1974), Acharya and Shukla (1975), Pradesh (1975), Sohani and Pawar (1977), Chiswick (1983), Ram Kumar (1985) and Ramesh (1988). All the above workers used Cobb-Douglas production function model due to its relative merits. In the production function analysis productivities of manures and fertilizers and irrigation were higher. The analysis clearly suggests that in order of priority, more expenditure on manures and fertilizers, irrigation, plant protection and seed will help in raising the level of production and productivity of Gram, Jowar + Arhar and Lentil crops under different situations on the sample farms.

With regard to poor income of the sampled farmers, it may be pointed out that these farmers have to operate under complex nature of economic, technical and institutional constraints. Unassured and irregular irrigation, lower yields of the existing varieties, absence of suitable varieties for mixed cropping, growing pulses under marginal and undulated land, non-adoption of improved management practices, non-adoption of plant protection measures, inadequate application of fertilizers, non-availability of good quality seed, competition with wheat and paddy, non-availability of salt resistant varieties and improved planting implements and gaps in knowledge about farming are the serious constraints to pulse production in the study area.

Regarding the technical know-how and the use of resources, it can be pointed out that it should be arranged according to the requirement of the existing conditions. Thus, for enhancing the productivity of pulses and income of the pulse growers, three components, i.e. irrigation, knowledge regarding the pulse production and credit are essential. Assured irrigation facilities have to be evolved in the areas wherever it is possible. With regard to knowledge about the cultivation of different crops in general and pulse crops in particular, the smooth transfer of technology generated in the research stations to the farmers require a highly complement and well informed extension services. It will not only build-up sound communication system with the farmers but also infuse confidence in them about the economic profitability of the new technology.

**Test of Hypothesis:**

The hypothesis number one that "there has been no growth or negative in area, production and productivity of pulses in the state" was approved as per findings given in Table V-1 of Chapter V.

The hypothesis number two that "in district Chitrakoot Dham division, the growth in area, production and productivity has been positive" was found to be valid as per results given in Tables V-2 to V-7 of Chapter V.

The hypothesis number three that "the costs and returns from pulses vary under different size groups" was found to be true as per the findings discussed in Table VI-8 to VI-29 in Chapter VI.

The hypothesis number four that "the production of pulses suffers from many constraints" was approved as per opinion survey.

Chapter - IX

# SUMMARY AND CONCLUSION

# SUMMARY AND CONCLUSION

The present problem entitled **"Production and productivity performance of pulses and their contribution in income and employment on farms in Chitrakoot Dham region of U.P. state."** was undertaken during the agricultural year 2001-02. The study aimed at studying the production, and productivity performance of pulses in the study area. It also analyzed the main constraints to production of pulses.

The study is based on an intensive enquiry of 100 pulse growers selected randomly from 10 villages of two blocks falling under the area jurisdiction of district Chitrakoot Dham. A multistage stratified random sampling technique was used to select the blocks, the villages and the respondents i.e. pulse growers. For the purpose of the study of price spread 50 cultivators who had brought their produce (pulse grains) for the disposal in the Chitrakoot Dham Regulated Mandi (selected purposively) were interviewed. Out of the 10 pulse processing units in Banda city, 3 units were selected randomly for the purpose of present study. The enquiry was conducted randomly for the purpose of present study. The enquiry was conducted by survey method. The primary data were collected by direct personal interview with the respondents. The secondary data were obtained from the block headquarters, district headquarters, village records, reports and journals.

The total geographical area of district Chitrakoot Dham was 790026 hectares out of which 64.20 percent area was under cultivation. Out of the total cultivated area, 18.18 percent area was under irrigation. The main crops of the district were pulses which occupied as much as 29.56 percent of the total cropped area of the district. The intensity of cropping of the district was only 123.40 percent because of large area under pulse crops.

Out of the total reported area of 59170 hectares and 70639 hectares of blocks Kamasin and Jaspura; 80.82 percent and 81.30 percent area was under cultivation. The intensity of cropping of block Kamasin was 103.26 percent and that of block Jaspura 104.60 percent. The pattern of land utilization of the selected blocks suggested that there is no scope of bringing more area under cultivation and production may be increased only by adopting more intensive agriculture.

The percentage irrigated area of the two blocks was 11.67 and 10.15, respectively. Pulse crops in block Kamasin and Jaspura had the highest percentage area being 49.55 and 48.36, respectively to total cropped area. The average yield of wheat crop in district Chitrakoot Dham during the year 2002-003 was 17.87 quintals per hectare that of paddy 10.49 quintals, maize 10.54 quintals, Urd 2.75 quintals, Moong 3.87 quintals, Gram 9.36 quintals, Pea 12.57 quintals, arhar 10.87 quin als, Sugarcane 397.98 quintals, Potato 193.73 quintals and Soybean 5.66 quintals.

Regarding the area, production and productivity of pulses in Uttar Pradesh, a declining trend was observed during the period 1990-91 to 2000-01. The area under pulses in Uttar Pradesh declined from 3724829 hectares to 2986047 hectares during the aforesaid period alongwith a compound growth rate of (-) 1.01 percent per annum. So far as the production is concerned, it's ratio was worked out to 1:0.79 and its growth rate remained at (-) 0.11 percent per annum during the period 1990-91 to 2000-01. Likewise the average yield varied from 8.24q/ha to 8.08q/ha alongwith a positive growth rate of (+) 1.47 percent per annum during the period mentioned above. The area, production and productivity for different pulse crops in Chitrakoot Dham division and the district varied considerably from year to year.

Thus, the study clearly reveals that increased production of pulses during the aforesaid period was due to the expansion of area under the crops on one hand and marginal increase in productivity on the other. The marginal increase in productivity shows that technology has not helped much to increase the production in the country as well as in the study area. This is to be viewed seriously in the context of various efforts being made to increase productivity through yield increasing technology.

Coming to the economic structure of the sample holdings, it was observed that the average size of holding came to 1.89 hectares. The percentage number of holdings was the highest in the lowest size group while the cultivated area contributed the highest percentage on

the largest size group of farms. This indicated the uneven distribution of cultivated land among the farmers of different sizes.

The average percentage irrigated area came to 15.99 percent on the sample farms. The higher percentage irrigated area was observed on larger size group of farms because most of them had their own sources of irrigation which in turn increased the percentage area under irrigation on these farms.

The per farm average investment in fixed capital came to Rs. 585477.91 including the value of land whereas it was Rs. 168195.37 excluding the value of land. The average investment in fixed capital per farm on land came to Rs. 207683.22. The total investment excluding land per farm showed an increasing capacity of big farmers.

On the average, gram occupied the highest area being 27.06 percent to the total cropped area followed by Jowar + Arhar 25.49 percent, Wheat 21.87 percent, Lentil 9.50 percent, Paddy 7.12 percent, Mustard 6.05 percent and others 2.91 percent. As regards different size groups, the area under cash and remunerative crops showed an increasing trend with the increase in the size of farms because of the fact that big farmers were putting more area under the cash crops. The average intensity of cropping was worked out to 115.07 percent. It varied from 109.03 percent on "0-2" hectares size group to 123.67 percent on "4 hectares and above" size group. Dry farming practices were generally adopted in the study area which resulted into the low intensity of cropping.

Gram is the main crop of district Chitrakoot Dham. On the average, it occupied 27.06 percent of the total cropped area on the sample farms. The average cost of cultivation of Gram came to Rs. 12646.37 per hectare. It showed a rising trend with the rise in the size of farms. The average yield per hectare of Gram came to 14.92 quintals of main product and 16.30 quintals of an average, was worked out to Rs. 807.51 for main product and Rs. 36.70 for by-product. It decreased with the increase in the size of farm due to higher yields in relation to cost of cultivation on the big farms. The average value of output per hectare came to Rs. 17227.00. The higher value of output on big farms was associated with the higher expenditure incurred on modern farm inputs. As regards with average values of net income, family labour income and farm business income per hectare, they came to Rs. 4580.68, Rs. 5344.92 and Rs. 6629.68, respectively on the sample farms of different sizes. The average input – output ratio in gram was worked out to 1:2.25. so far as the average values of cost A, cost B and cost C are concerned, they came to Rs. 7840.03, Rs. 11804.03 and Rs. 12646.37 respectively on the sample farms. The income over the respectively costs were calculated at Rs. 6042.77, Rs. 4975.95 and Rs. 4336.32, respectively.

As regards with average input cost, output value, net income, family labour income, farm business income and input – output ratio their values were worked out to Rs. 8386.59, Rs. 5434.02, Rs. 4580.68, Rs. 5757.04, Rs. 9073.04 and 1:1.47 per hectare in Jowar + Arhar on the sample farms of different sizes, respectively. In the mixed cropping of Jowar + arhar, average values of cost A, cost B and cost C

came to Rs. 7007.70, Rs. 10950.11 and Rs. 4903.47 per hectare, respectively. The average income over cost A, cost B and cost C were also calculated at Rs. 9704.45, Rs. 5757.04 and Rs. 4903.47 per hectare, respectively on the sample farms. All these values increased with the increase in the size of farms as result of higher output in relation to total input cost.

On an average, the values of cost A, cost B and cost C came to Rs. 3930.06, Rs. 7655.55 and Rs. 8553.27 per hectare, respectively on the sample farms in the production of Lentil crop. These costs increased with the increase in the size of farms. The average income per hectare over cost A, cost B and cost C were calculated at Rs. 16115.89, Rs. 12390.40 and Rs. 11492.68, respectively. The income over different costs also increased with the increase in the size of farms because of higher output in relation to total input cost.

Coming to the average value of input cost in Wheat + Gram, it came to Rs. 10811.32 per hectare. The per hectare yield was worked out to 9.86 quintals of main product and 15.49 quintals of by-product from wheat and 7.12 quintals of main product and 8.55 quintals of by-product from gram. The average values of output, net income, family labour income and farm business income were calculated at Rs. 17172.15, Rs. 6360.83, Rs. 7327.96 and Rs. 10573.94, respectively on the sample farms of different sizes from Wheat + Gram. Regarding the input – output ratio in Wheat + Gram, it was worked out to 1:2.21. On an average, cost A, cost B and cost C in Wheat + Gram came to Rs.

6106.16, Rs. 9844.02 and Rs. 6360.83 per hectare, respectively on the sample farms. The income over different costs was also calculated at Rs. 11065.89, Rs. 7327.96 and Rs. 6360.83 per hectare, respectively. The income over different costs was low in the smallest size groups as compared to the largest size group of farms due to low level of output in relation to total input cost.

In the farm business as a whole, on the average, per hectare total input cost on the sample farms came to Rs. 11516.23. It was higher on the largest size group of farms because they could incur higher expenditure because of their better economic status as compared to the small size group of farms. Likewise the average value of input cost on per farm basis in crop production as a whole on the sample farms was worked out to Rs. 21046.92. Out of which rental value of land contributed the highest being 28.22 percent followed by human labour 27.15 percent. The values of human labour were noted higher on larger sized farms in comparison to smaller one. It was because of their higher investment capacity.

The average values of net income, family labour income and farm business income on per farm basis came to Rs. 28243.26, Rs. 33394.99 and Rs. 46095.22, respectively. All these values were higher on large farms. The large sizes farms could invest more on modern inputs like – quality seed, manures and fertilizers, irrigation etc. which inturn resulted into higher yield and income on these farms. The values of cost A, cost B and cost C, on an average, came to Rs. 13193.83, Rs. 15894.19

and Rs. 20146.92 as a whole on per farm basis on the sample farms. A size group-wise examination indicated that all these costs showed an increasing trend with the increase in size of farms. It was due to higher investment capacity on the big farms. As regards average income over different costs, they gave also an increasing trend with the increase in size group of holdings. It was due to higher yield and income on the big farms on per hectare basis as well as on per farm. The per farm average income over cost A, cost B and cost C were calculated at Rs. 46095.20, Rs. 33394.99 and Rs. 28243.26, respectively on the sample farms of different size groups.

Regarding the production function analysis in Gram, Jowar + Arhar, Lentil the marginal value productivities of fertilizers varied form Rs. 5.5778 on Jowar + Arhar to Rs. 8.9319 on Lentil crops while those of irrigation varied from Rs. 5.2183 on Jowar + Arhar to Rs. 6.9426 on Gram crop under different situations. Likewise one rupee investment in plant protection resulted into an additional income varying from Rs. 5.0819 on Jowar + arhar to Rs. 6.6158 on Lentil crops under different situations. As regards returns to scale, increasing returns to scale was noticed for all the crops on the sample pulse grower's farms.

From the above finding it may be concluded that their existed still much scope for increasing the yields and income of the pulse growers. The dependence of pulses cultivation on rains and rain fed canal, use of local seeds and lack of technical know – how under existing

condition, major share of mill owner and other agencies in the marketing of pulses etc. were the main constraints in having returns from pulse production. There is need to overcome these problems so that the farmers may get their due share in pulses production. The adoption of new dry farming technology and basal application of fertilizers would go a long way in increasing the production and productivity of pulses in the study area. The efficient marketing and processing of pulses through farming co-operative would provide better return to the pulse producer.

**Policy Implications:**

In the recent years the gap between production and demand of pulses have widened pulses largely due to stagnation on production of pulses on one hand and increasing population on the other hand. The Central and State Govt. have taken several measures to minimize this gap but the situation has not yet improved. Urgent measures are needed to reverse this trend of winding gap between demand and supply of pulse sin the country. The following policy measures may be suggested for it's productivity.

**(I) Provision be made for the following :**

1- Quality varieties capable of resisting diseases need to be evoived. Pulse Zonal Research Stations for different agro climatic sub regions may co-operate in this regard.

2- (i) Irrigation is no less important a factor. At present irrigation is given. In the event of rains one more irrigation can be given.

(ii) Effort should be made to reduce the cost of irrigation.

3- More irrigation automatically attracts more fertilizers; hence suitable doses of fertilizers are also necessary. Manures and fertilizers both should be applied.

4- Since the crops stand in the field for a longer period, they have more chances of attack of insect-pest and diseases. All pulses zones need adequate efficient and timely treatment of these diseases and pests. State help in this regards would be important.

5- Credit is an important aspect for pulse production. More and more of an institutional credit be made available to pulse growers to meet the heavy expenses involved in pulse production.

**(II) Institutional and operational factors :**

1. Credit distribution, input supply and pulses development are all not well linked. This necessitates a proper liaison between all these agencies concerned with pulse economy.

2. Suitable extension services regarding new technology of production, disposal and utilization of pulses should be extended to the pulse growers without any delay by extension workers and other agencies involved in the extension, communication in their respective zones.

3. One objective of the policy implications to increase the pulse production should be to ensure the crops through Insurance Agency (ies) in the country as well as in the study area.

The adoption of new dry farming technology and basal application of fertilizers would go a long way in increasing the production and productivity of pulses in the study area. The efficient marketing and processing of pulses through farming co-operative would provide better return to the pulse producers.

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